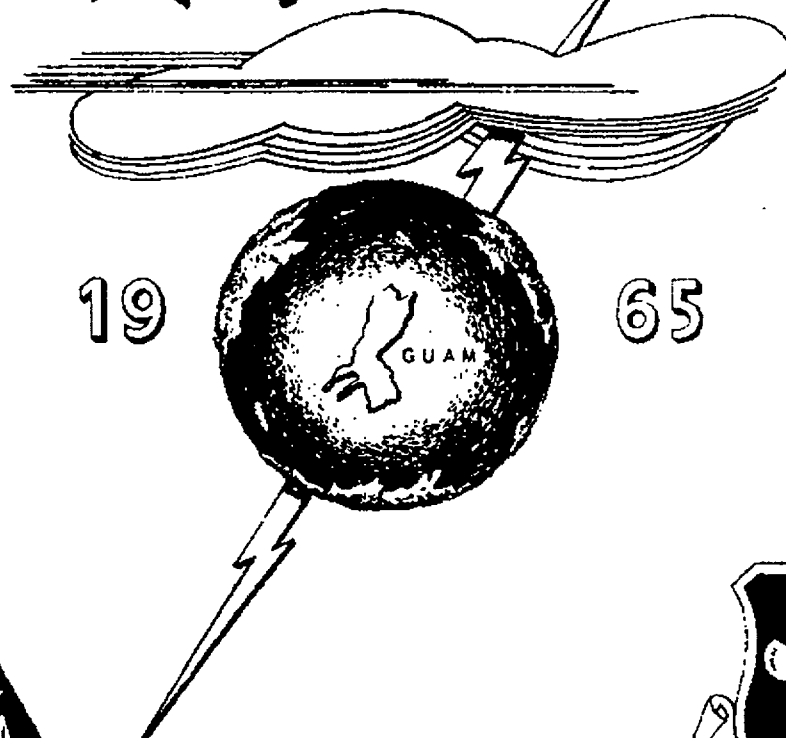


# ANNUAL TYPHOON *Report*



**FLEET WEATHER CENTRAL/JOINT TYPHOON WARNING CENTER**  
**Guam, Mariana Islands**

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1965

ANNUAL TYPHOON REPORT

U. S. FLEET WEATHER CENTRAL/  
JOINT TYPHOON WARNING CENTER  
COMNAVMARIANAS BOX 12  
SAN FRANCISCO, CALIFORNIA

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3140  
Ser: 60  
15 February 1966

From: Commanding Officer, U. S. Fleet Weather Central/Joint Typhoon  
Warning Center, Guam, M. I.  
To: Chief of Naval Operations  
Via: Commander in Chief, U. S. Pacific Fleet

Subj: Annual Typhoon Report, 1965; submission of

Ref: (a) OPNAV Instruction 3140.17E of 29 October 1965  
(b) SECNAV Instruction 5600.16 of 2 November 1960

1. The Annual Typhoon Report, 1965, is submitted herewith in accordance with reference (a).
2. During calendar year 1965, a total of 21 typhoons, 13 tropical storms and six tropical depressions occurred in the Western Pacific area between 180°E longitude and the Malay Peninsula, north of the equator. There were 805 warnings issued in this area in 1965. A new record of 167 calendar days in warning status was established in 1965.
3. Reference (a) directed the Fleet Weather Centrals at Pearl Harbor and Alameda to forward summaries of tropical cyclones in their areas to Fleet Weather Central/Joint Typhoon Warning Center Guam for inclusion in the subject report. Fleet Weather Central Alameda issued a total of 241 warnings on one hurricane, nine tropical storms and two tropical depressions in their area of responsibility. One of these tropical storms (DOREEN) crossed to the west of 140°W and Fleet Weather Central Pearl Harbor issued three warnings on this cyclone. A complete summary of tropical cyclones east of 180 degrees longitude is included in Annex A.
4. One interesting fact of the 1965 typhoon season was that a record number of "super typhoons" (i.e., sustained surface winds of 130 knots or more) occurred in the FWC/JTWC Guam area of responsibility. There were 11 typhoons in this category which surpassed the previous record of eight.
5. This report has been reviewed and approved in accordance with reference (b).

  
J. F. STEUCKERT



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HQ, IWW (40)  
HQ, 9TH WEA GRP (2)  
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HQ, THIRD AIR DIV (8)  
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## FOREWARD

This report is published annually and summarizes Western North Pacific Tropical Cyclones. Effective this year, Annex A is added to summarize Tropical Cyclones from 180 degrees eastward to the North American Coast.

When directed by CINCPAC in May 1959, CINCPACFLT redesignated Fleet Weather Central Guam as Fleet Weather Central/Joint Typhoon Warning Center (FWC/JTWC), Guam with the following responsibilities:

1. To provide warnings to U. S. Government agencies for all tropical cyclones west of 180 degrees longitude north of the equator to the Asiatic coast and Malayan Peninsula.
2. To determine tropical cyclone reconnaissance requirements and assign priorities.
3. To conduct investigative and post analysis programs including preparation of the Annual Typhoon Report.
4. To conduct tropical cyclone forecasting and detection research as practicable.

Fuchu Air Force Weather Central, coordinating with Fleet Weather Facility Yokosuka was designated as alternate JTWC in case of failure of FWC/JTWC Guam.

The JTWC, which is an integral section of FWC/JTWC Guam, is staffed by three Air Force and three Navy meteorologists and three enlisted men from each service. The senior Air Force Officer has been designated as the Director, JTWC.

The Joint Hurricane Warning Center in Hawaii, a coordinated agency composed of the U. S. Weather Bureau, Honolulu, the Air Force Kunia Weather Center, and Fleet Weather Central Pearl Harbor, is responsible for surveillance and issuance of warnings in the Central North Pacific area north of the equator between 180 degrees and 140 degrees west.

The Fleet Weather Central, Alameda, California, is responsible for issuance of warnings between 140 degrees west and the North American Coast.

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## **CHAPTER I**

### **OPERATIONAL PROCEDURES**

## A. GENERAL

Within the Fleet Weather Central/Joint Typhoon Warning Center (FWC/JTWC), the basic analysis is the responsibility of the Fleet Weather Central (FWC). Micro-analysis, forecast aid evaluation and the warnings described below are the functions of the Joint Typhoon Warning Center (JTWC). Basic chart prognoses that are received from Fleet Numerical Weather Facility (FNWF), Monterey, California, are utilized, in addition to locally prepared progs.

## B. ANALYSES

### 1. FWC

a. Types of contour (c) and/or streamline (s) charts with standard times:

- (1) Surface; 0000Z, 0600Z, 1200Z and 1800Z (c).
- (2) Gradient level (2000 to 3000 ft. above ground); 0000Z, 0600Z, 1200Z and 1800Z. (s)
- (3) 850mb; 0000Z and 1200Z (s).
- (4) 700mb; 0000Z and 1200Z (s) & (c).
- (5) 500mb; 0000Z and 1200Z (s) & (c).
- (6) 300mb; 0000Z and 1200Z (c).
- (7) 200mb; 0000Z and 1200Z (s).
- (8) Sea Surface Temperature Chart; 5-day mean composite updated once daily.

b. Cross sections for selected tropical Pacific stations.

- (1) Checkerboards or Stidd Diagram.
- (2) Time Cross Sections.

### 2. JTWC

a. Micro-analysis:

- (1) Sectional charts; hourly and 3-hourly as required.
- (2) Reconnaissance reports.
- (3) 700mb; 0000Z and 1200Z, 10-meter interval analysis (c).
- (4) 500mb; 0000Z and 1200Z, 20-meter interval analysis (c).

b. Satellite data. (See Chapter II for details).

## C. FORECAST AIDS

These are listed in alphabetical order and priority of importance is not indicated.

## 1. Climatology

In preparation for issuance of the initial warning on a tropical cyclone, a track based on climatology is developed. This track is prepared for a time interval of 4 or 5 days at the speed indicated by climatology. The following climatological publications are utilized when constructing the original forecast track for each cyclone:

- a. Climatological Aid to Forecasting Typhoon Movement (1st Weather Wing)
- b. Annual Typhoon Report, 1964 (covering years 1953-1964; FWC/JTWC)
- c. Western Pacific Typhoon Tracks 1950-1959 (FWC/JTWC)
- d. Far East Climatic Atlas (1st Weather Wing - February 1963)
- e. Tropical Cyclones in the Western Pacific and China Sea Area (Royal Observatory, Hong Kong). This comprehensive publication covers 78 years of typhoon tracks.

Next, the track is modified in accordance with the existing and forecast upper air pattern, after which the initial warning is prepared and issued. The forecast track is extended and modified with time, as reconnaissance fixes are received and the synoptic upper air pattern changes.

## 2. Computer Products

During the 1965 Typhoon Season the following computer products were received and used extensively by JTWC:

### a. From FNWF

(1) Steering computations, or forecast positions, for 6, 12, 18, 24, 36, 48, and 72 hours for TD's, TS's and Typhoons (as requested by JTWC). These computations are prepared at 0000Z, 0600Z, 1200Z and 1800Z daily.

- (2) 700mb, 500mb, 300mb, and 200mb height and wind analyses.
- (3) 700mb, 500mb, 300mb, and 200mb 24-hour prognoses.
- (4) 700mb, 500mb, 300mb, and 200mb 36-hour prognoses.
- (5) 700mb, 500mb, 300mb, and 200mb 48-hour prognoses.
- (6) 72-hour 500mb height and wind prognosis.

### b. From NMC, Suitland

(1) NWP Barotropic prog positions for typhoons for 12, 24, 36, 48, 60 and 72-hours were received when, in the opinion of NWP, the progs were reasonable.

NMC items were received twice daily for the synoptic times 0000Z and 1200Z.

c. JTWC utilized computer steering computations, computer prognostic constant pressure charts and synoptic analyses subjectively modified as the basis for forecasting typhoon movement during the 1965 season. (See Chapter II for an explanation and evaluation of techniques).

### 3. Individual Objective Methods

During the 1965 typhoon season, the following individual objective methods were used by JTWC:

- a. WANG - Using 700mb data.
- b. AROWA - Using 700mb or 500mb data.
- c. FAIRLESS - Using surface data.

### 4. Coordination

When a circulation for which warnings are being issued is north of 25N, Fuchu Air Force Weather Central transmits coordination forecasts twice daily to JTWC. Coordination with other Air Force and Navy activities is on an "as required" basis depending upon the location of a particular tropical cyclone.

## D. WARNINGS

Warnings are filed and transmitted every six hours at synoptic times of 0000Z, 0600Z, 1200Z and 1800Z. In accordance with CINCPAC Instruction 3140.1F the message contains the present warning position of the tropical cyclone which is valid for the scheduled transmission time. Therefore, the 24 and 48-hour warning forecast positions are actually 30 and 54 hour forecasts from the last synoptic time.

The warning position of a tropical cyclone is actually a short range forecast from the last "best" position. The last "best" position is usually about 3 hours old based on land radar or reconnaissance fixes, 3 to 6 hours old based on surface synoptic reports, or 6 to 12 hours old based on upper air synoptic reports. It is for this reason that the 0600Z warning, for example, may not agree with the position of the tropical cyclone as indicated by the 0600Z analysis. Amendments are issued when this difference is significant.

The numbers of tropical warnings run consecutively regardless of whether the cyclone is upgraded or downgraded from tropical depression, tropical storm or typhoon. If warnings are discontinued and the circulation regenerates, the new series of warnings are numbered consecutively from the number of the last warning of the previous series. Amendments and corrections which are issued as required are given the same numbers as the warning which they amend or correct.



All 24, 48 and 72 hour forecasts made when a tropical cyclone is of tropical storm or typhoon intensity are verified against the "best tracks" as determined in post-cyclone analysis.

The 1965 verification summary is contained in Chapter IV.

## CHAPTER II

### EVALUATION OF TECHNIQUES

## A. GENERAL

Aerial reconnaissance is the only method available which provides sufficient data for the proper analysis of a tropical system. Land stations in the Tropical Pacific are widely scattered and ship reports are concentrated along the shipping lanes which do not generally pass through areas of formation and development of tropical systems. Since most of the ships which are near developing systems take evasive action as soon as the first warning is issued, surface data is generally sparse in the vicinity of a typhoon. Aerial reconnaissance, being mobile, provides the position, intensity, indications of past movement, significant features such as eye shape, size and slope, and any changes which occur while the aircraft is near the storm. By using dropsondes or making an ascent or descent sounding, the reconnaissance aircraft are able to obtain the lapse rate profile to the surface, sea level pressure, and surface temperature and dew point at any point.

The accuracy of warnings is directly related to the quality and quantity of aircraft reconnaissance of tropical systems. Continuous surveillance is required on all tropical systems so that initial warnings may be issued in time to insure proper preparations for safeguarding life and property. In the future, part of this early surveillance may be covered by use of satellites equipped with Automatic Picture Transmission (APT).

## B. SURVEILLANCE METHODS

During 1965, two aircraft squadrons were assigned the primary responsibility for tropical reconnaissance under the requirements of the Joint Typhoon Warning Center, Guam. These units were the U. S. Navy Airborne Early Warning Squadron ONE (VW-1) which is based at Naval Air Station, Agana, Guam, and the U. S. Air Force 54th Weather Reconnaissance Squadron (54WRS) which is based at Andersen Air Force Base, Guam.

The U. S. Air Force 56th Weather Reconnaissance Squadron (56WRS) based at Yokota Air Base, Japan, was the primary backup for the 54WRS and provided all low level fixes assigned to the 54WRS until mid-year 1965.

The aircraft used by the various squadrons were the EC121K Warning Star by VW-1, the WB-50 by 56WRS, and the WB-47 by 54WRS until mid-year, when the WC-130 was phased into the inventory as a replacement for the WB-47.

Land radar was utilized as a backup for aerial reconnaissance when a tropical system was within radar range. This information was available from various weather radar and tactical radar sites and proved to be very useful.

TIROS satellite reports were also utilized during the 1965 season and were useful to JTWC in locating areas of possible storm formation.

### C. EVALUATION OF AERIAL RECONNAISSANCE

During the 1965 season four fixes per day were scheduled on all typhoons and at least two fixes per day on all tropical storms. Tropical depressions were scheduled for one or more fixes per day depending on location and potential. To allow sufficient lead time for aircraft deployment on developing systems, many tropical storms, which were expected to develop into typhoons within 24 hours or were in critical areas, were also scheduled for four fixes per day. In general low or intermediate (1500 ft or 700mb) level fixes were made by VW-1 at 0900Z and 1500Z while intermediate (700mb) level fixes were provided by the 54WRS and 56WRS at 0300Z and 2100Z. During the first half of the season the 54WRS made high (300mb) level fixes using the WB-47 aircraft.

Both VW-1 and 54WRS flew synoptic tracks and investigations throughout the season.

In spite of problems associated with higher priority missions, a large percentage of the fixes and investigations requested were completed.

### D. EVALUATION OF DATA

#### 1. Aerial Reconnaissance Data

Aerial reconnaissance data can be divided into three categories: peripheral data, eye data from penetration, and eye data from radar.

Peripheral data is all information reported enroute to and outside the eye of the storm. It includes weather, sea level pressure if aircraft is at low level or pressure-height if at mid or high-level, complete description of clouds including types, amount and height of bases and tops if feasible, flight altitude wind, temperature and dew point, and the surface wind if the sea surface is visible. Dropsonde data was also provided by the WB-50 and WC-130 aircraft and by the EC121K as feasible. This same type of data is provided on all synoptic tracks and investigations. All of the peripheral data obtained by the WB-47 aircraft was at the 30,000 ft level. The WB-50 and the WC-130 usually flew at 700mb but on occasion flew at 500mb, or 1500 ft. EC121K aircraft normally flew either at 1500 feet or 700mb, but at times mountainous terrain required the flight to be at 500mb.

Eye data from penetration includes all information reported in peripheral data plus eye size, shape, description, slope, cloudiness, maximum flight level wind, surface wind and surge, if any, and other remarks which might be of help to the forecaster such as feeder band description, direction and speed of movement of the center, etc. If possible, a dropsonde is also made in the eye. If the wind, cloud, pressure and radar eye do not coincide, the type eye reported is specified and bearing and distance given to any others.

Eye data from radar provides a description of the radar eye and its location, including description of spiral bands and height and width of the wall clouds. Also included is the aircraft position at the time the radar observation is taken and the maximum observed winds if possible.

On all eye messages a center selection evaluation of either Positive, Fair or Poor is given along with an estimate of the navigation accuracy of the fix and a statement of the type of navigation fix used by the aircraft. These were used by JTWC as a guide in evaluating fix accuracy. With radar fixes from a considerable distance, attenuation can distort the radar image; therefore, this must be considered when evaluating a fix.

During 1965 daylight penetrations were made on all but a few of the most severe storms. When possible, EC121K aircraft also penetrated the storms, mainly on the evening fixes but often at nighttime also. These penetrations were normally made at 1500 ft or below on the evening fix and 700mb at night.

The data obtained by the various squadrons was accurate and complete with a very few exceptions. Crew experience varied widely through all the squadrons, with mostly "old hands" remaining from the 1964 season at VW-1. Due to the phase-in of a new type aircraft, crew experience in typhoon work was low in the 54WRS early in the year. However, there was a rapid increase in effectiveness during the latter half of the season. One difficulty faced by all three squadrons was that of obtaining good navigation fixes in those areas where loran navigation is poor.

#### COMPARISON OF RECON FIXES AND BEST TRACK POSITIONS

(Average Distance of Fix from Best Track)

For Tropical Depressions	17 miles
For Tropical Storms	16 miles
For Typhoons	11 miles
Average for all fixes on all storms by all squadrons for the 1965 season	13 miles

The information received from all reconnaissance aircraft was continually checked for consistency and accuracy. Where possible, JTWC graphs and other aids were used to check and compare fix data with previous reports. Verification was requested from the observing aircraft on any apparent discrepancy in the data.

#### 2. Land Radar

Land radar reports were used in conjunction with aircraft reports whenever possible. These reports included range and bearing of the eye from the reporting station, eye characteristics and occasionally the direction and speed and movement of the eye. A combination of attenuation, operator inexperience and the fact that the radar could see only the top of the storm made distance land radar reports often inaccurate. However, as the storm approached the station, the accuracy usually improved markedly.

### 3. Satellite Reports

Miscellaneous satellite bulletins giving information on tropical systems were received periodically throughout the season. While many of these bulletins provided only a verification of previous fixes by other methods, on a few occasions they were very useful as the basis for scheduling investigative missions, and led indirectly to the location of a few tropical storms. Satellite bulletins would be much more useful to JTWC if their receipt were more timely. In most instances, several hours elapsed between the time of observation and the time of receipt of the bulletin.

It is interesting to note that during the 1965 season Tropical Depression 23 and Tropical Storm DOREEN were fixed visually by Lieutenant Colonel COOPER on the Gemini Five flight while passing over the Central Pacific. This is thought to be a first in fixes on tropical cyclones.

### E. COMMUNICATIONS

The primary means of communications between ground and aircraft was voice single sideband for the 54WRS from both the WC-130 and the WB-47 aircraft. For VW-1 and the 56WRS, the primary means was radiotelegraph (CW). For all aircraft, AIE2, Andersen AFB, Guam was the primary air to ground contact, with AIF8, Yokota AB, Japan; AIF2, Fuchu Air Station, Japan; and AIC2, Clark AB, Republic of the Philippines acting as secondary stations. Data received by AIE2 was relayed to JTWC via local circuit 3L28. This circuit also serves VW-1 and the 54WRS. When the data was first received by one of the secondary stations, it was transmitted primarily by DCS addressed message to JTWC. Also there is an "on call" pony loop RATT circuit connecting Japan with AIE2 which may be used as necessary.

When aircraft were in contact with AIE2, most reports were received in JTWC in sufficient time to enable the forecaster to make a comprehensive study of the data before warning time. However, when the aircraft was working secondary stations, many times the reports were unavailable at JTWC before warning time and had to be tracked down by the forecaster through use of long distance telephone links or "wirenotes." This was especially true of AIC2, where the use of regular DCS addressed messages often led to a delay of up to 24 hours in time of receipt. This situation was encountered with practically all fixes in the South China Sea and, without the use of Fleet Weather Facility Sangley Point as an alternate relay point, it would have been even more of a problem. The establishment of the cable connection between Guam and the Philippines has helped reduce this problem in 1965.

The following are some revealing statistics on communications delays encountered in 1965 along with figures from previous years for comparison.

DELAYS IN RECEIPT OF TYPHOON  
RECONNAISSANCE FIX DATA

	<u>1963</u>	<u>1964</u>	<u>1965</u>
MAX DELAY TIME	5 hrs.10 min	6 hrs.45 min	60 hrs.09 min
AVG DELAY TIME	1 hr. 02 min	1 hr. 14 min	1 hr. 05 min
MIN DELAY TIME	"few minutes"	8 minutes	9 minutes
% OF EYE MESSAGES DELAYED MORE THAN 1 HOUR	33%	59%	39%
NUMBER RECEIVED AFTER WARNING TIME	22	46	34
% RECEIVED AFTER WARNING TIME	5%	8%	6%

F. SUMMARY OF RECONNAISSANCE SUPPORT

In an effort to make the crediting of the reconnaissance effort more objective and meaningful, a system was devised to credit fixes and investigative flights as to their timeliness. First of all, the problems of why a fix was missed, early or late, although of interest and concern to JTWC, belong to the Tropical Cyclone Reconnaissance Coordinator (TCRC). The criteria used were dictated by warning times and communications delays. Obviously it would be desirable to have the fix delayed to as near warning time as possible, but the communications delays have been such that fixes must be made about 3 hours before warning time. This allows ample time to digest the information after receipt of the data. This system is described below:

DEFINITIONS OF RECONNAISSANCE CREDITS  
FIXES

<u>CLASS</u>	<u>DEFINITION</u>	<u>CRITERIA</u>
1	Full Credit	From 1 hour before to $\frac{1}{2}$ hour after levied time
2	Full Credit	No center or eye found, but otherwise falls into Class 1 above
3	Early/Late	Greater than 1 hour but not more than $1\frac{1}{2}$ hours before levied time or greater than $\frac{1}{2}$ hour but not more than 2 hours after levied time
4	Very Early or Late	Greater than $1\frac{1}{2}$ hours before or 2 hours after the levied fix time

<u>CLASS</u>	<u>DEFINITION</u>	<u>CRITERIA</u>
5	Attempted but missed fix	Attempt made by squadron with no eye/center fix made, but some useful peripheral data provided. Reasons may be clearance problems, mechanical problems, etc., etc.
6	Missed Fix	Due to complete abort, aircraft that got airborne but provided no useful data, basic restrictions, refused by squadron for unspecified reasons, etc.

#### INVESTIGATIVE FLIGHTS

<u>CLASS</u>	<u>DEFINITION</u>	<u>CRITERIA</u>
A	Full Credit	Satisfactory job of reconnaissance and made a fix on a tropical cyclone
B	Full Credit	Satisfactory job of reconnaissance, but no fix made
C	Early/Late	In area as specified in Class 3 above, and did a satisfactory job of reconnaissance
D	Very Early or Late Inves.	Greater than 1½ hours before or 2 hours after levied time to be in suspect area
E	Attempted but missed Inves.	Attempt made by squadron but thorough investigation of suspect area not accomplished. Some peripheral data was provided. Reasons may have been clearance problems, mechanical problems, etc., etc.
F	Missed Inves.	Due to complete abort, aircraft that got airborne but provided no useful data, basic restrictions, refused by squadron for unspecified reasons, etc.

This system, although as objective as possible, requires subjective evaluation of some fixes. For example, a plane could be in the area assigned on time when the storm had accelerated unexpectedly and could not be reached within the normal time limits by the reconnaissance aircraft. In this case, full credit would be given with no penalty for being late.

Applying the above criteria for the 1965 season, the following statistics are obtained:

#### EVALUATION OF TIMELINESS OF RECONNAISSANCE FOR 1965

<u>FIXES</u>		<u>INVESTIGATIONS</u>		<u>FIXES &amp; INVESTIGATIONS</u>
<u>Class</u>	<u>Number</u>	<u>Class</u>	<u>Number</u>	<u>TOTALS</u>
1	503	A	27	530
2	36	B	46	82
3	40	C	--	40
4	13	D	1	14
5	9	E	1	10
6	27	F	--	27



When more than one aircraft made a fix at the same levied time, only one fix was credited.

JTWC plans to use punch cards and automate as much as possible the crediting of reconnaissance efforts during 1966 so that, in years to come, exact comparisons can be made.

As a matter of interest, there were 240 synoptic tracks flown in 1965. Synoptic tracks include "trans-Pac", training flights that make weather observations, etc. and are flights that are requested by the squadrons. It is estimated that somewhere between 10% and 20% of the synoptic flights cover an area that might have required an investigative flight.

#### G. EVALUATION OF NUMERICAL WEATHER PRODUCTS

During 1965 operational steering forecasts based on numerical prognoses were received at JTWC from the Fleet Numerical Weather Facility (FNWF) Monterey, California, and occasionally from the National Meteorological Center (NMC), Suitland, Maryland. Due to the proximity of most typhoon tracks to the boundary of the NMC grid, the NMC forecasts were of limited use.

Operational steering predictions were furnished by FNWF on all Tropical Cyclones during 1965. Computations were provided at two different steering levels, 500mb and 1000mb, and also a modified combination of these two. The steering predictions proved very helpful for comparison with other data.

#### H. EVALUATION OF OPERATIONAL FORECAST PROCEDURES

The basic forecasting technique used throughout the 1965 season was a subjective modification of the numerical steering prediction. Modifications were based on climatology (see Chapter I), and subjective evaluations of micro-analyzed 700, 500, 300 and 200mb charts, with emphasis on the 700mb chart.

If the steering forecast looked reasonable, it was then checked for consistency with climatology and past history. The upper air charts were checked for areas of maximum divergence, areas offering the least resistance to the forward motion of the storm and the 700mb height criteria of Wang. An AROWA grid computation was made on both the 700mb and 500mb charts for most forecasts. In addition, a FAIRLESS computation was made on the surface chart for most forecasts, especially in the early stages.

A subjective integration of all the factors listed above was then used to establish or modify the forecast track of the system. Speed of movement was then forecast from history, climatology, and the steering forecast.

## CHAPTER III

### JTWC STUDIES

This Chapter is a collection of studies conducted during the 1965 typhoon season. Some topics appear in their entirety. Other topics are of a continuing nature and will be completed when data becomes available.

The following is a list of the topics discussed in this chapter:

- A. TYPHOON HARRIET - RAPID MOVEMENT BEFORE RECURVATURE
- B. TYPHOONS AMY AND FAYE - UNUSUALLY FAST MOVEMENT AFTER RECURVATURE
- C. AN EXAMPLE OF FALSE RADAR EYE DEVELOPMENT
- D. AN EXAMPLE OF DIFFERENTIAL MOVEMENT AT TWO LEVELS
- E. EXTRATROPICAL SURGE
- F. TIROS VERIFICATION
- G. THE STATISTICAL VERIFICATION PROGRAM
- H. FINAL REPORT ON 700MB NUMERICAL GRID
- I. CHANGES IN SEA SURFACE TEMPERATURE (SST) RESULTING FROM THE TRANSITING OF TYPHOONS SHIRLEY AND TRIX
- J. CHANGES IN MIXED LAYER DEPTH (MLD) RESULTING FROM THE TRANSIT OF TYPHOONS SHIRLEY AND TRIX

A. TYPHOON HARRIET - RAPID MOVEMENT BEFORE RECURVATURE

Typhoon HARRIET was picked up as a tropical depression south southwest of Guam, and remained quasi-stationary for 30 hours, gradually building up to a tropical storm of 35 knots. It then moved north northeast until it was turned to the west by the middle level easterly flow, still as a 35-knot storm.

In the next 12 hours after curving to the west, HARRIET built up to a 65-knot typhoon and accelerated to 24-knot forward speed. For the next 3½ days, until it dissipated over Central China, the storm continued to intensify and moved west northwest at forward speeds of between 16 and 24 knots, with an average forward speed of 18.1 knots. This was in an area where climatology shows an average speed of 11 to 14 knots for this time of year.

A check of the upper air charts for the period showed no indication of any strong easterly "steering current." In fact, the only significant winds were 40-45 knot southerly winds at 700mb in the southeast quadrant of the storm. This is usually considered an indicator of slower movement and intensification. Throughout the period the 500mb and 700mb subtropical ridge to the north remained weak, and all indications pointed to a closed circulation to 300mb, another indicator of slow movement.

The only unusual feature of the storm which did not fit a forecast of slow movement was the building of a north-south ridge at 300mb and 500mb to the east of the storm, with a very flat gradient to the west. This increase of heights behind the storm may have resulted in some form of ageostrophic flow to the west around the storm. However, on the basis of the sparse data available, no definite cause has been found for the rapid movement of the system.

## B. TYPHOONS AMY AND FAYE - UNUSUALLY FAST MOVEMENT AFTER RECURVATURE

Typhoon AMY was one of the fastest moving typhoons ever seen in the Western Pacific. It first reached typhoon intensity east of Luzon and immediately started moving north northeast around the western edge of the subtropical high. It accelerated and deepened gradually until, by 260600Z May 1965, it was a 100 knot storm moving north northeast at about 28 knots. At this time it was still a small, shallow, intense system located approximately 180 miles southeast of Okinawa. A fairly deep major trough was located near 123E, with a closed low over the Central China coast at 700mb.

In the next 24 hours the 700mb low deepened and moved to a position south of the tip of Korea, with the trough at 300mb also deepening and moving off the Asian Mainland. Since the subtropical high to the east did not weaken appreciably, a low level jet developed in the air mass surrounding Typhoon AMY, with 700mb wind speeds in excess of 50 knots. Typhoon AMY began to accelerate rapidly, with little decrease in intensity.

By 261800Z, AMY was moving north northeast at about 40 knots, with maximum sustained winds of 80 knots, and by 270000Z it was moving at 46 knots with the storm still of typhoon intensity. Three hours later it crossed the eastern side of Tokyo Bay with wind speeds of about 45 knots and became extratropical northeast of Tokyo.

Another type of system which often moves very rapidly is the typhoon which is becoming extratropical. This type is typical of late or very early season storms. Typhoon FAYE, of November 1965 is an excellent example.

FAYE was a deep storm with a well developed 300mb low at 250000Z and was moving northeast at about 30 knots. At that time, the storm showed indications of an extratropical surge, with a rapid weakening of the eye of the storm and an increase in 700mb temperature at the center from 16 to 21 degrees centigrade in a period of six and one half hours. From the data available, this temperature rise was associated with the destruction of the closed low above 700mb. Immediately after this the storm accelerated rapidly, moving at an average speed of 65 knots between 251200Z and 251800Z. At this time FAYE was technically extratropical, but it still contained winds of over 65 knots and the area covered by winds in excess of 30 knots extended as much as 350 miles from the center.

Using AMY and FAYE as examples, the following are suggested as possible guides to rapid movement of systems which have recurved:

1. Small, intense storms.
2. Shallow storms (top of circulation below 300mb).
3. Storms which are becoming extratropical.
4. Rapid deepening in the major trough position upstream, resulting in a southward movement of the jet stream into the path of the storm.

### C. AN EXAMPLE OF FALSE RADAR EYE DEVELOPMENT

When Typhoon DINAH passed over Taiwan on the 18th and 19th of June 1965, it provided a well documented case of false eye development. The false eye was picked up by land radar, TIROS, and both visually and on radar by reconnaissance aircraft (see Figure 3-1) while the actual circulation center was verified by doppler winds.

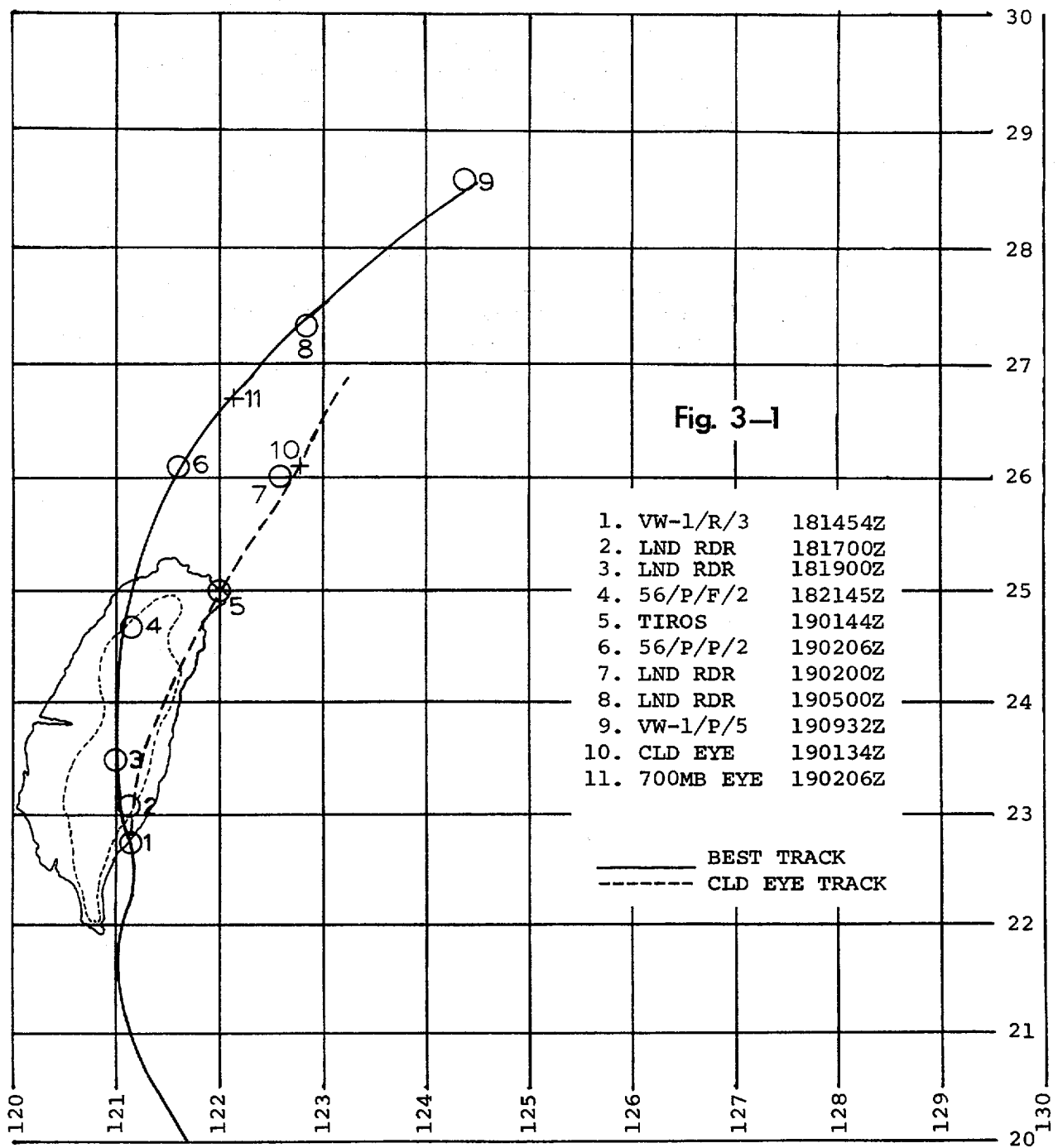
An EC121K aircraft of VW-1 made a radar fix on Typhoon DINAH over the southeast coast of Taiwan at 181454Z. At that time the storm was well defined, with a wall cloud 3-5 miles thick just moving over land. At 181500Z the wall cloud was still well enough defined to be picked up by land radar on Miyako Jima, about 265 miles from the storm. However, by 181900Z the storm center had moved over the central highlands of Taiwan and land radar reported the eye had dissipated, although the center could still be estimated by using spiral overlays on the feeder bands.

At 182145Z an Air Force WB-50, with Captain A. C. Korelishn aboard as Weather Officer made a fix of the 500mb wind center over north central Taiwan. At that time he reported no radar returns or clouds at flight level, but a definite wind circulation. The reconnaissance flight was continued with a 700mb circumnavigation of the island, during which southerly surface winds of 45 knots were observed off the east coast. At 190100Z the aircraft was contacted by a land radar station, which vectored it into a "radar eye" near 26.1N 122.8E. The following is quoted from a post flight report by Captain Korelishn.

"The radar returns were circular in nature and they almost formed a completely closed circle except for the south quadrant. Visible tops ranged from 8-9 to 15 thousand feet. The echo width averaged 4 miles and the intensity of the returns was strong. Once entry had been made into the center of the radar return, it visually showed all signs of a typhoon cloud structure. Circular bands of strato-cumulus, with center tops to 4 thousand feet increasing in height to 8 thousand feet were welded into the wall cloud. The 7/8 cloud coverage allowed sufficient area to view the sea surface. The wind field on the surface was well defined 180-190 degrees at 40 knots while flight level winds at 700mb remained at approximately 210-220/30-35 knots."

After leaving the "cloud eye," the WB-50 put the wind on its wing and located a 700mb wind center at 26.6N 122.2E. Since the surface wind at this point was still approximately 150/25 knots, the search was continued, and a surface wind center located at 26.1N 121.6E at 190206Z. (Approximately 60 miles west of the cloud center). In the meantime, TIROS reported a center at 25.0N 122.0E at 190144Z and Shimen land radar reported an eye at 26.0N 122.6E at 190200Z, near the cloud eye reported earlier by the aircraft.

Land radar reports at 190500Z and a VW-1 penetration at 190932Z indicated that a wall cloud started to form around the surface wind center during the next 12 hours. In fact, VW-1 reported a partial wall cloud 5 miles thick in the northeast quadrant. No further reports were received of the cloud eye to the east, which apparently dissipated.



TRACK OF TYPHOON DINAH OVER TAIWAN  
JUNE, 1965

It is interesting to note that, except for airborne reconnaissance, all available data between 181700Z and 190500Z indicated a track at least 60 miles to the right of the actual storm movement, and would undoubtedly have forced a forecast of recurvature well south of Kyushu. Actually, the storm followed the forecast track and moved over central Kyushu as an extra-tropical system.

This "shearing off" of a cloud (and radar) eye during the passage of a storm over a steep mountain range has been observed at least once before, during the passage of Hurricane FRANCES over Guadeloupe Island in the Caribbean Sea on 1 October 1961. It has been suspected in typhoons before, but this is the first case in which synoptic reports of both centers were available.



#### D. AN EXAMPLE OF DIFFERENTIAL MOVEMENT AT TWO LEVELS

In its early stages, the cyclone that later became Typhoon JEAN was a good example of the damping effect of differential advection on a center.

JEAN was picked up as T.D. 17 on the 26th of July, 1965, between Truk and Eniwetok. At that time, winds of 30 knots were reported, and both low level Southern Hemisphere indrafting and divergence at 200mb favored fairly rapid development.

The 700mb contour pattern and the surface pressure pattern for 270000Z are typical of those occurring in the following three days. The 700mb (and 500mb) patterns showed a weak trough in the westerlies well to the north of the tropical depression, with an almost continuous ridge 10 degrees north of the center and an apparent "steering flow" to the west northwest. On the other hand, the surface pattern showed a deep trough to the north and a comparatively tight gradient in the southerly winds east of the center.

The resulting movement over Guam - and an estimate of the movement of two earlier surface centers - is shown on the attached chart (figure 3-2). The 700mb low apparently followed a regular track to the west northwest at about 14 knots. However, each time a surface low developed, it immediately tried to move north northwest and weakened rapidly as it moved out from under the low aloft. This is shown clearly by the lower levels of the Guam rawins during the time the center was passing (figure 3-3). The surface center, with very light winds, passed just north of Guam, while the center above 8000 feet passed to the south. Guam actually experienced a dead calm and thick fog during the passage of the center.

After three more days, the 700mb and surface flow became parallel, and Typhoon JEAN developed in the no data area between Guam and Luzon.

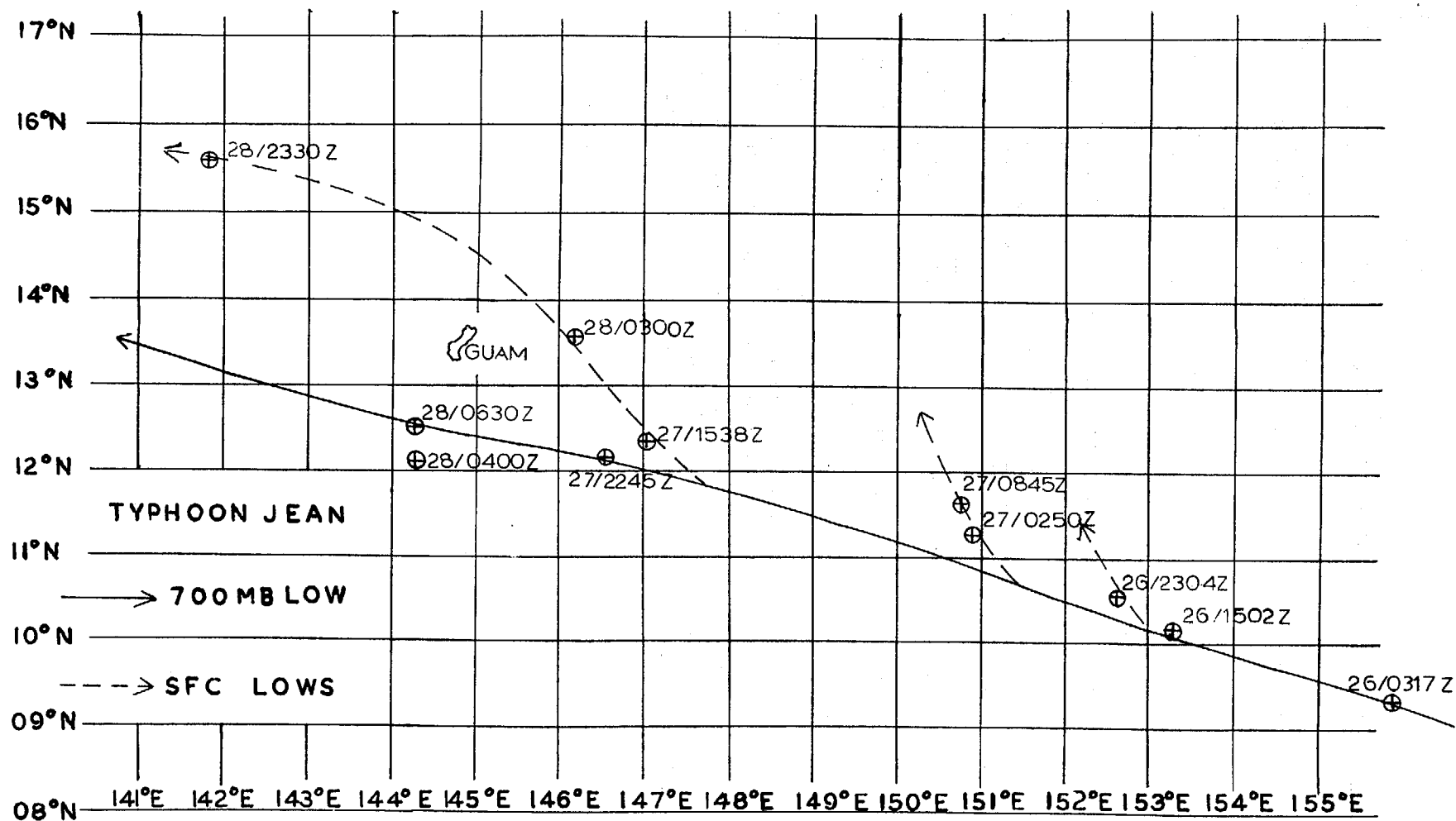
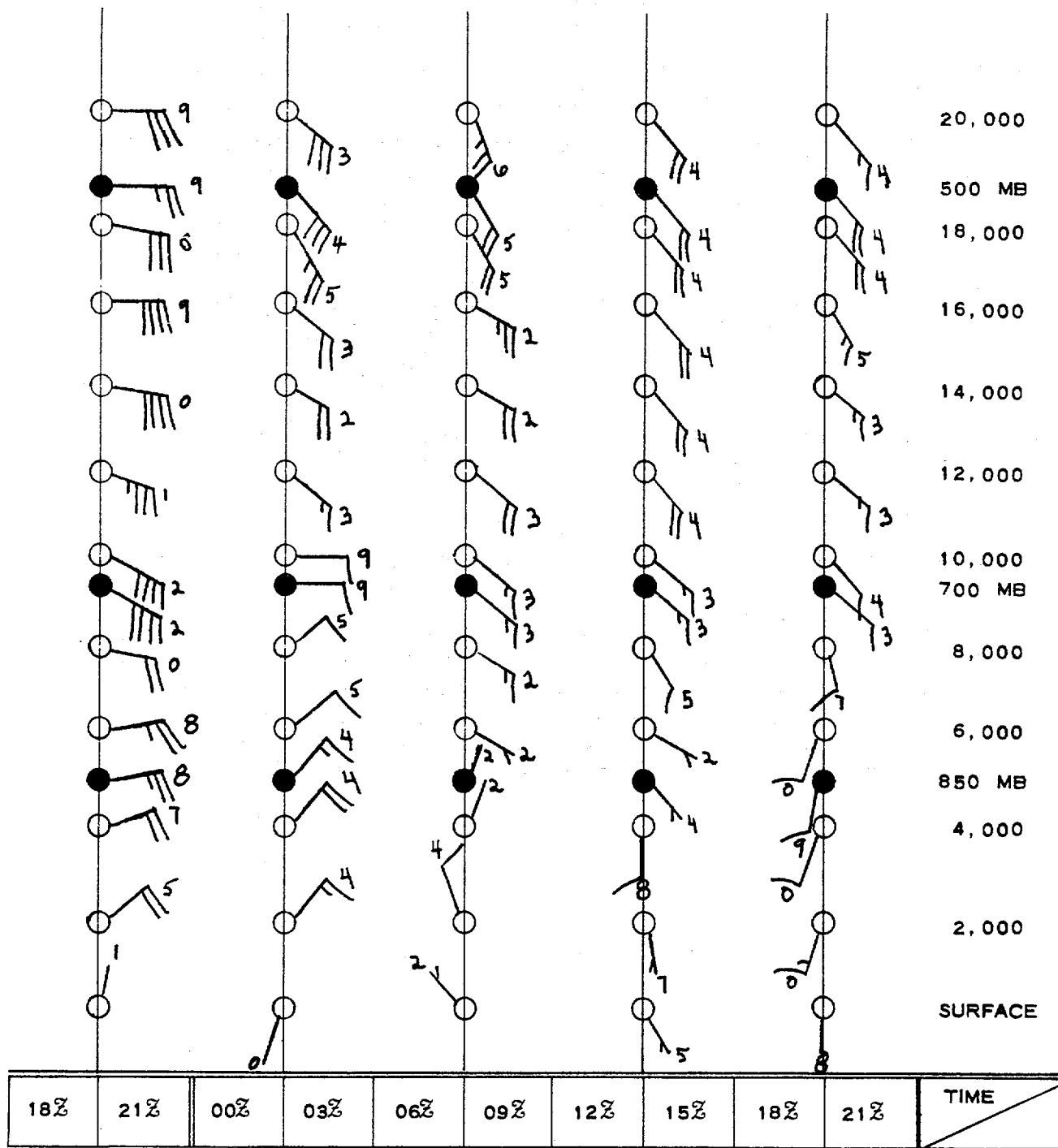


Fig 3-2



# GUAM RAWINS TO 20,000' 27-28 July 1965

Fig. 3-3

## E. EXTRATROPICAL SURGE

Following the analysis of extratropical surge in Typhoon HOPE (See JTWC Studies in the 1964 Annual Typhoon Report), a search was made for other well documented examples of this phenomenon. In most cases, it was found that operational reconnaissance did not give the coverage necessary to fully outline the surge process. However, two additional examples have been found which fit the pattern observed in Typhoon HOPE and in 14 other cases observed since 1962 data available indicates the process did occur, although complete documentation is lacking.

Typhoons JUDY (October 1963) and BESS (October 1965) have been plotted, using the moving coordinate technique outlined in the 1964 report. Due to the subjective nature of surface wind reports, only 700mb doppler winds have been analyzed for these two storms, but otherwise the charts are similar to those made for Typhoon HOPE.

Typhoon JUDY has been included in this study because of the large rise in 700mb center temperature at a relatively high latitude and the excellent peripheral data, especially in the south and west quadrants. The track of the storm was very similar to that followed by Typhoon BESS two years later. On the 2nd of October 1963, sparse available data showed a flat temperature gradient of 9-11 degrees C. at 700mb surrounding a small 17 degree center, with maximum 700mb winds of 55-60 knots except for one 80 knot report 30 miles south southwest of the eye. By the 3rd (figure 3-4) a tongue of cold air had penetrated to the south quadrant of the storm, with a 70 knot 700mb wind maximum ahead of it about 100 miles from the center. Reconnaissance center reports indicated an eye 3 miles in diameter with moderate to severe turbulence and maximum 700mb winds of 110 knots near the wall cloud at 022200Z. By 030405Z the center had enlarged to 8 miles in diameter with maximum 700mb winds near the center of 90 knots.

On the 4th (figure 3-5) reconnaissance reported a poorly defined eye, with no strong winds near the center. The cold air had almost completely cut off the warm air tongue at this time, with an 80 knot wind maximum on the leading edge of the cold air tongue. In spite of the cut-off of the warm air tongue, the 700mb temperature at the center rose to 21 degrees at 032100Z and 24 degrees at 040400Z over a very small area.

Here again, no operational requirement could justify a flight on the 5th of October. The last reported data was a flight by a VW-1 aircraft into the center on the evening of the 4th, which found maximum 700mb winds of 67 knots and a center temperature of 21 degrees C.

Typhoon BESS was a large storm with a circulation over 600 miles across and surface winds near 150 knots which moved almost due north near 144E during early October 1965. By the 3rd of October it had turned to the northeast near 31N and accelerated slightly to 12 knots forward speed with winds at both surface and 700mb weakening slowly. The chart for the daylight

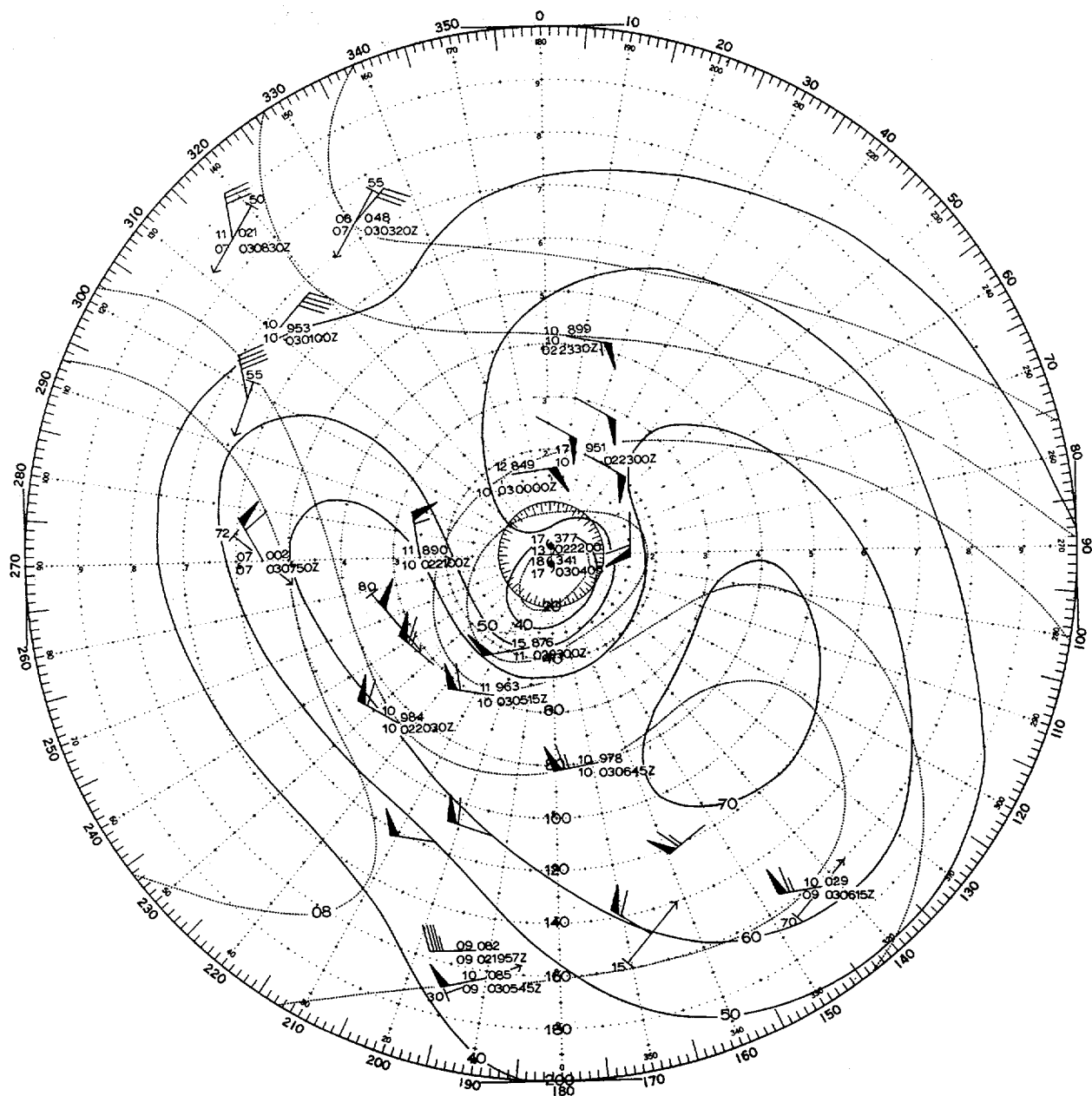


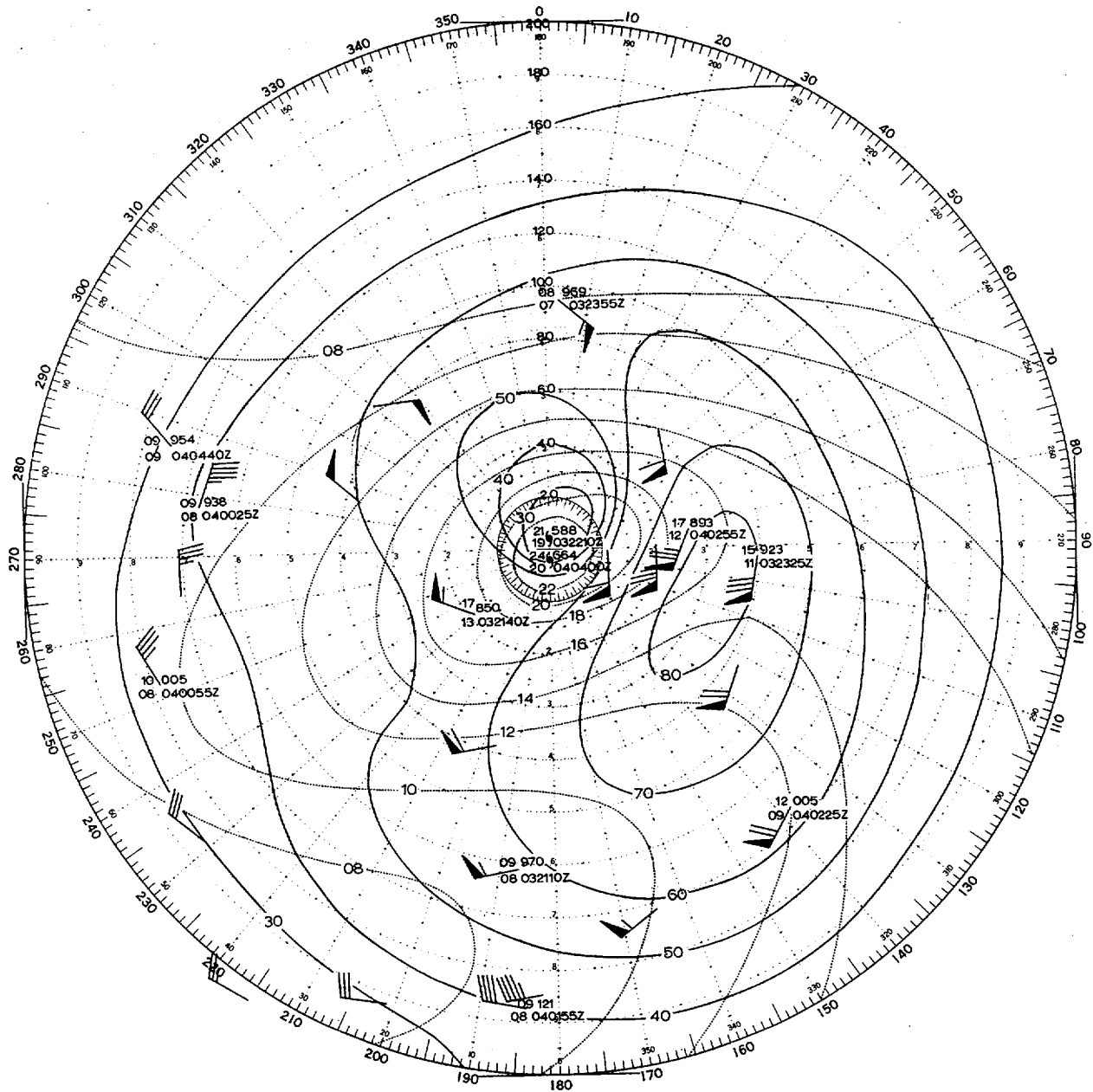
Fig. 3-4

JULY

3 OCT 1963

700MB TEMPERATURE

700MB ISOTACH



JUDY  
 4 OCT. 1963  
 700MB TEMPERATURE  
 700MB ISOTACH

fixes October 3rd (figure 3-6) shows a small 60 knot wind maximum in the southeast quadrant about 50 miles from the center and a 50 knot maximum in the northwest quadrant on the leading edge of the cold air tongue. By the next day (figure 3-7) the cold air had swung into the south quadrant and the maximum wind area was lying 60-80 miles southeast of the center, with 700mb winds in excess of 70 knots. A second maximum of about 70 knots was located 80-100 miles northwest of the center on the leading edge of the warm air tongue.

Here again, as in Typhoon HOPE in 1964, no operational requirement could be used to justify reconnaissance of the extratropical system on the following day. However, what peripheral data existed showed the development of a normal extratropical warm type occlusion with surface winds of 50-60 knots.

Typhoon BESS was unusual in that the 700mb temperature in the center rose to a maximum of 21 degrees C. on the 3rd, then dropped back to 18 degrees on the 4th. This was probably due to the extreme northward movement of the center, which was at 35N on the 4th. In almost every other case studied the high center temperature at 700mb remained until the system was completely extratropical.

Another interesting feature of BESS was the movement of the maximum surface wind belt. The maximum surface winds moved from 30-40 miles from the center on the 4th to 60-100 miles from the center on the 5th. Even on a qualitative basis this represents a tremendous increase in kinetic energy in the system.

It appears from the evidence available that extratropical surge is a common phenomenon, especially in early and late season storms. Although the effects are masked by changes due to landfall, it is probable that the same process is responsible for the sudden increases in intensity occasionally observed in the eastern quadrant of storms approaching Japan (and possibly also those approaching the Gulf Coast of the United States). It is felt that a modest research effort, such as a double penetration at 1500 feet and 700mb by doppler equipped aircraft every 6-12 hours while the process is going on would yield considerable useful data.

With the installation of new equipment programmed for reconnaissance aircraft, additional data will be obtained which should determine the relationship between the 700mb and low level wind fields.

In the meantime, from evidence at hand, the following are suggested as some typical changes in a storm becoming extratropical.

1. Wall cloud dissipates and clouds in center become stratiform.
2. 700mb height in center rises 50-100 meters in 24 hours.

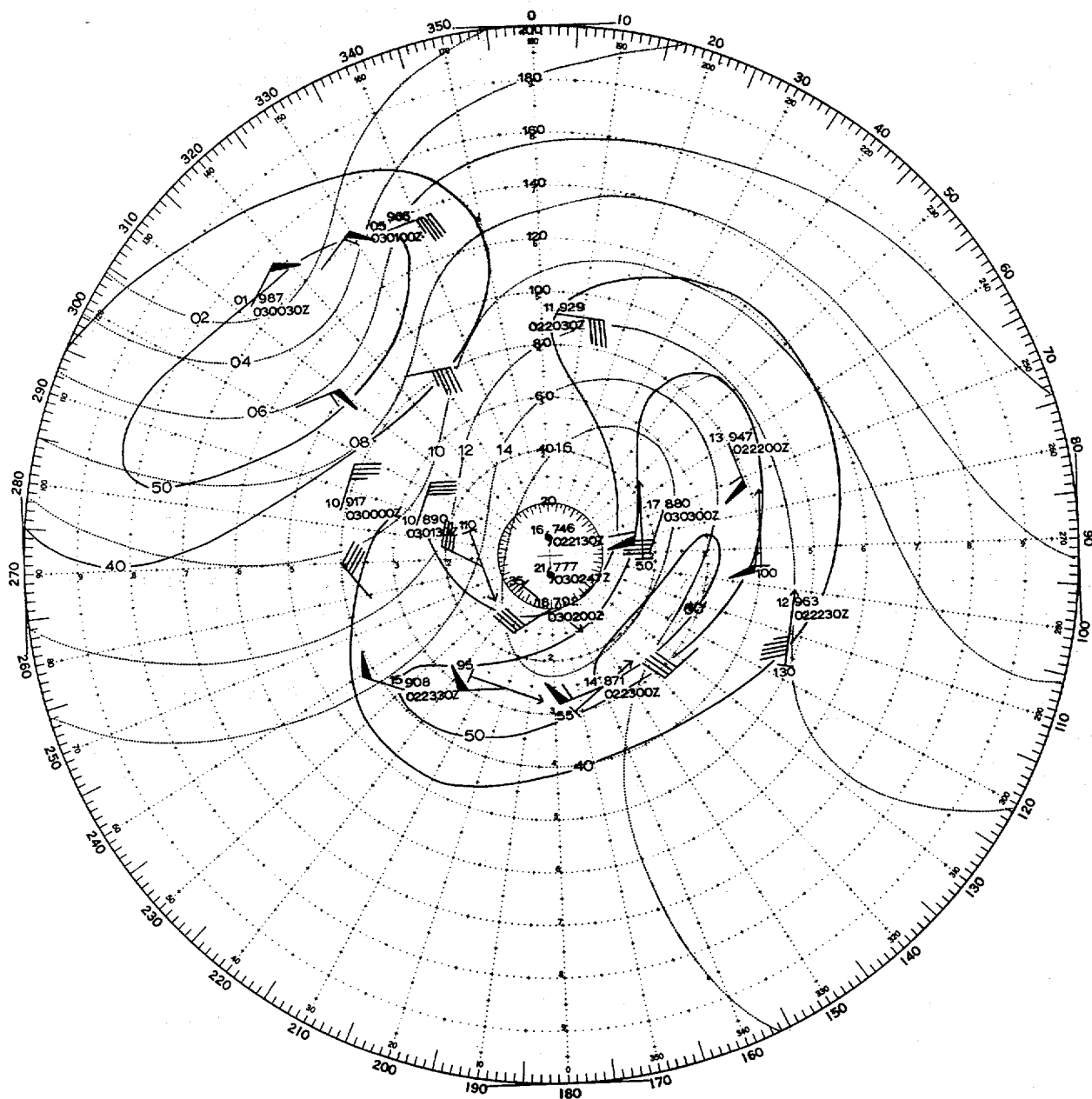


Fig. 3-6  
BESS  
3 OCT. 1965

— 700MB TEMPERATURE  
- - - 700MB ISOTACH



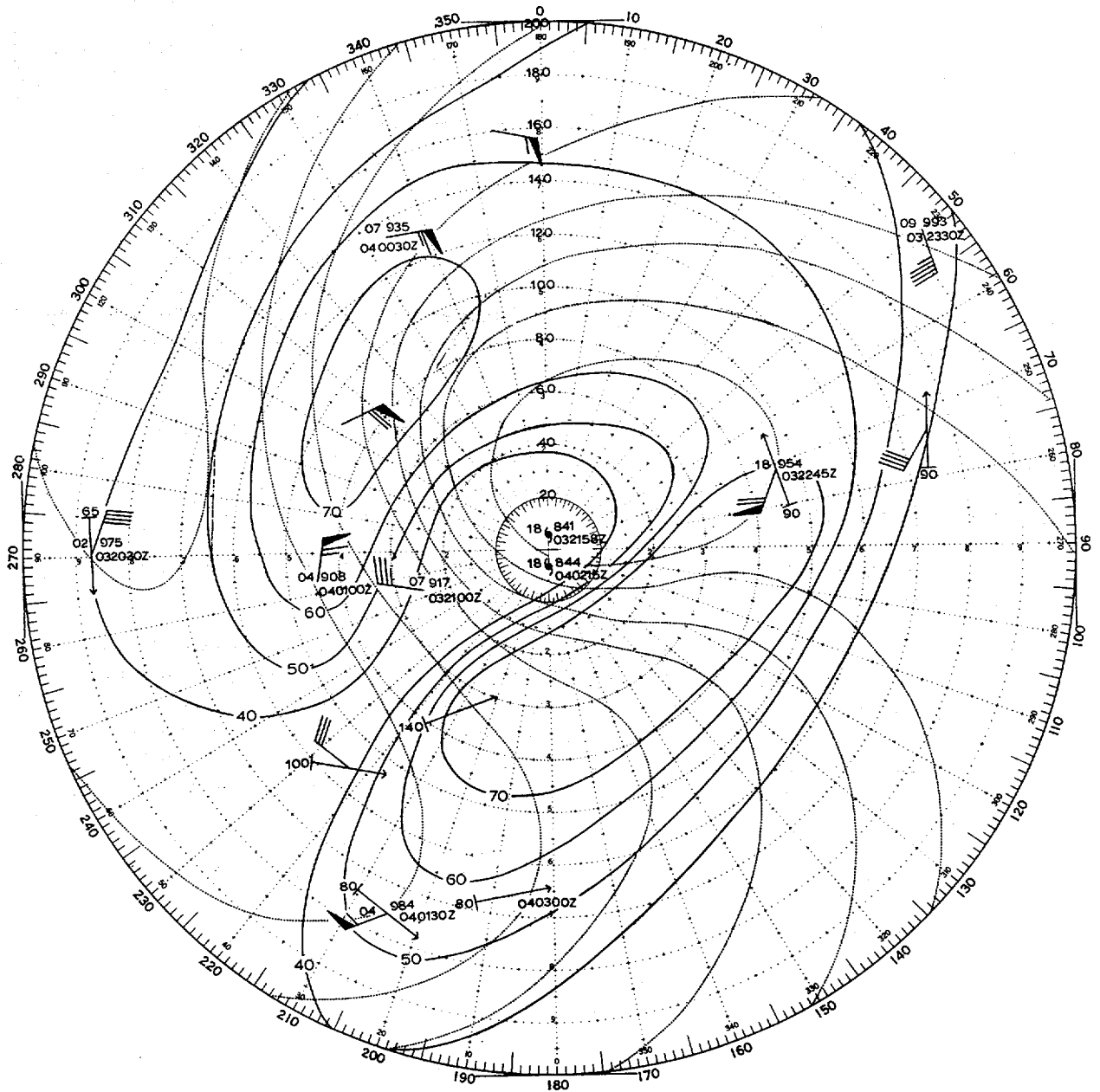


Fig 3-7  
 BESS  
 4 OCT. 1965  
 ——— 700MB TEMPERATURE  
 - - - 700MB ISOTACH

## F. TIROS VERIFICATION

During the 1965 typhoon season satellite information was used in conjunction with other meteorological data to evaluate the synoptic situation. In some cases the initial information received indicating a suspect area was supplied by the satellite bulletin.

This verification was compiled to determine the accuracy of the data furnished by satellite bulletins. Stage A reports were not verified. Stage B, C, and D reports were verified using average values indicated by figure 3-8 when diameter and band information was not available. Figure 3-9 was used when diameter and band information was available.

Table 3-1 shows the statistics that were used in this verification. The information in columns 3, 8, 9, 10, and 11 was received by message. From a comparison of columns 2 and 3 of table 3-1, the location error in nautical miles (column 4) was obtained. The TIROS wind estimate (column 5) was obtained utilizing the diameter (DIA) and bands (BNDS) (columns 10 and 11 of table 3-1) and entering figure 3-9. The difference between columns 5 and 6 yielded column 7.

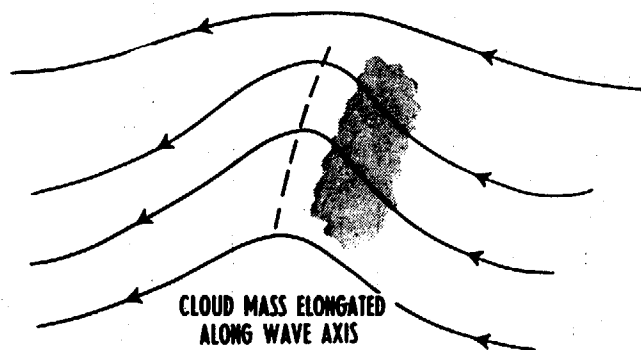
When wind speeds changed significantly along the best track the wind speed was interpolated for verification purposes. Otherwise the wind speed at the previous warning time was used. The wind error average over 61 verified cases was seventeen knots. This error would be significant for cyclones in the initial stages of formation but become progressively less significant as the intensity of the storm increased.

The TIROS storm positions were verified against the storm best track. The accuracy of 75 satellite positions varied from 0 to 425 miles with an average error of 81 miles.

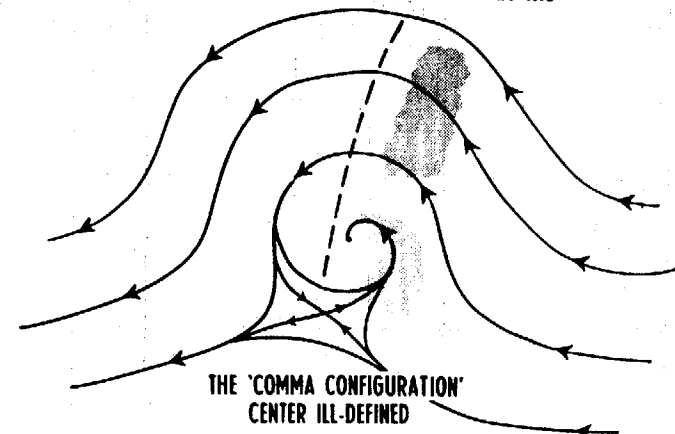
NOTE: Figure 3-8 and 3-9 are taken from: Memorandum, U. S. Department of Commerce, Weather Bureau: 18 June 1964, Subject: NWSC Support to Hurricane and Typhoon Forecast Centers

## FORMATIVE STAGES OF TROPICAL CYCLONE DEVELOPMENT

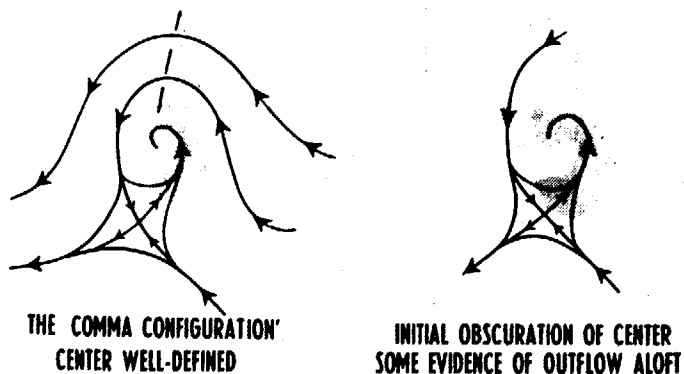
**A.** THE TROPICAL DISTURBANCE  
( NO CLOSED SURFACE ISOBARS )



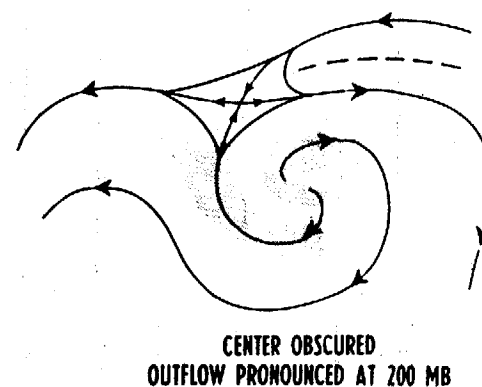
**B.** THE TROPICAL DEPRESSION I  
MAX. CENTRAL ISOTACH LESS THAN 20 KTS



**C.** THE TROPICAL DEPRESSION II  
MAX. CENTRAL ISOTACH 20-30 KTS



**D.** THE TROPICAL DEPRESSION III — TROPICAL STORM I  
MAX. CENTRAL ISOTACH 31-40 KTS



**Fig 3-8**

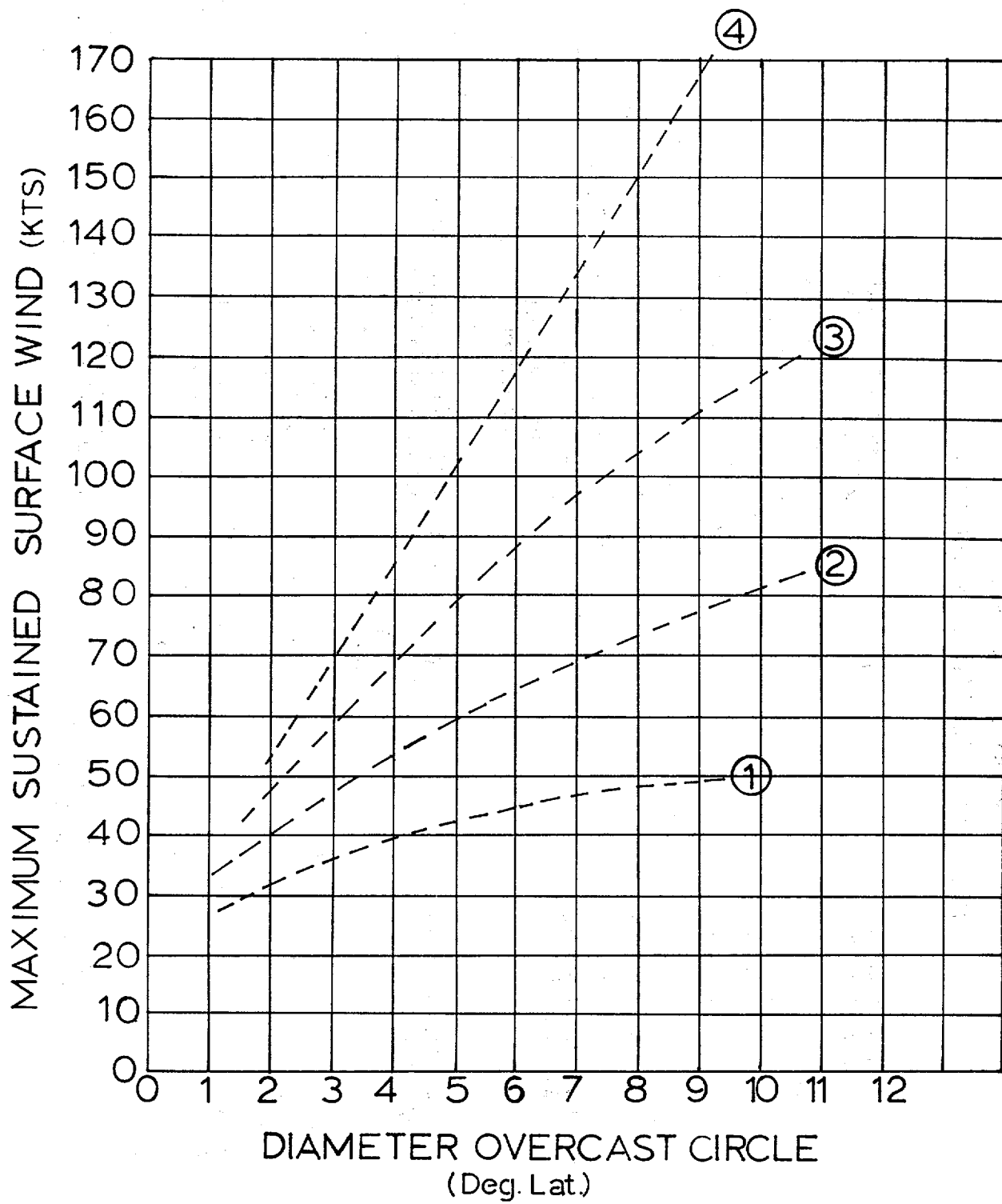


Fig. 3-9

# TIROS VERIFICATION STATISTICS - 1965

CYCLONE	POSIT	POSIT	POSIT	TIROS	BEST	WIND	TIME	STAGE	DIA	BNDS
	BEST TRACK	SATELLITE	ERROR	WND	TRACK WND	DIFF	ZULU			
PATSY	13.4N 128.3E	13.5N 127.5E	43	40	Formative	--	190408	D	4	1
	17.0N 129.1E	18.0N 128.0E	86 *65	60	65	-05	210314	X	5	2
SARAH	07.0N 111.0E	07.0N 111.0E	0	--	--	--	140530	-	-	-
	06.8N 108.4E	07.0N 107.0E	87	43	45	-02	150523	D	5	1
	07.6N 104.9E	09.5N 104.0E	123 *70	--	40	--	160711	-	-	-
VERA	10.4N 128.2E	12.0N 127.0E	117 *117	35	35	+00	060426	D	5	0
AMY	09.8N 131.1E	11.0N 128.0E	195 *195	40	25	+15	210216	D	4	1
BABE	15.4N 112.5E	15.0N 113.0E	37	--	60	--	010411	-	-	-
	15.9N 113.8E	17.0N 115.0E	98 *68	56	50	+06	020323	D	4.5	2
CARLA	24.1N 125.6E	23.0N 127.5E	120	70	100	-30	020225	X	4	3
	29.2N 129.6E	29.0N 129.5E	10 *65	20	30	-10	030219	B	X	X
DINAH	11.1N 148.3E	11.0N 149.0E	43	43	25	+18	110056	X	5	1
	11.6N 144.4E	12.5N 142.5E	125	43	--	--	120050	D	5	1
	12.2N 139.8E	13.0N 140.0E	51	60	65	-05	130037	X	5	2
	14.3N 131.6E	14.0N 131.0E	37	90	110	-20	150221	X	5	3+
	14.4N 131.2E	15.0N 131.0E	37	105	110	-05	150511	X	5	4
	15.9N 127.7E	15.8N 128.4E	43	105	130	-25	160212	X	5	4
	17.4N 123.9E	17.5N 124.0E	11	105	150	-55	170158	X	5	4
	20.7N 121.2E	21.0N 122.0E	49	90	140	-60	180152	X	5+	3+
	25.9N 121.5E	25.0N 122.0E	63 *51	37	40	-03	190144	X	3	1

\*AVG ERROR PER STORM

TABLE 3-1

CYCLONE	POSIT BEST TRACK	POSIT SATELLITE	POSIT ERROR	TIROS WND	BEST TRACK WND	WIND DIFF	ZULU	STAGE	DIA	BNDS
EMMA	18.3N 124.2E 22.6N 124.4E	17.0N 120.0E 17.0N 120.0E	253 425 *336	-- 48	50 45	-- +03	240251 250250	- X	- 8	- 1
FREDA	13.5N 135.5E 14.4N 127.9E 17.1N 123.3E 18.3N 116.9E 20.5N 110.5E	16.0N 134.0E 13.0N 128.0E 17.5N 125.0E 17.0N 117.0E 19.5N 111.0E	175 83 103 77 65 *101	42 92 105 96 88	70 120 140 85 100	-38 -28 -35 +11 -12	090039 120206 130158 140147 150142	X X X X X	5 7 8 7 6	1 3+ 3+ 3 3
GILDA	13.3N 132.2E 18.9N 118.6E 19.3N 112.4E 21.5N 111.3E 21.4N 108.2E	13.0N 128.0E 17.5N 117.0E 18.0N 112.0E 20.0N 110.0E 19.0N 108.0E	245 123 77 113 140 *140	-- -- 60 54 60	-- 35 60 35 Dissipated	-- -- +00 +19 --	170119 200053 220236 230225 240217	A A X X X	X X 5 4 5	X - 2 2 2
HARRIET	11.1N 143.1E 13.5N 141.3E 17.6N 134.6E	07.5N 140.0E 14.0N 141.0E 17.0N 133.0E	283 35 97 *128	-- 80 80	35 65 70	-- +15 +10	220031 230026 240016	- X X	- 5 5	- 3 3
JEAN	11.8N 150.0E 18.1N 130.6E 23.2N 127.5E 25.6N 126.8E	10.0N 149.0E 18.0N 132.0E 23.0N 127.0E 25.5N 127.0E	123 80 31 15 *62	20 70 78 85	25 75 90 130	-05 -05 -12 -45	270155 010158 030240 040212	B X X X	X 4 4 4	- 3 3+ 4
KIM	30.8N 142.4E	31.5N 142.5E	41 *41	58	45	+13	050143	X	3	3
LUCY	--- 26.8N 143.7E 31.2N 137.8E 33.6N 137.6E	11.0N 177.0E 27.0N 144.0E 31.0N 137.5E 33.5N 137.5E	-- 20 20 10 *17	-- 78 85 102	-- 120 120 120	-- -42 -35 -18	112348 190123 210216 220137	A X X X	X 5 4 5	X 3 4 4

\*AVG ERROR PER STORM

TABLE 3-1 (Cont'd)

## TIROS VERIFICATION STATISTICS - 1965 (Cont'd)

CYCLONE	POSIT		POSIT		POSIT ERROR	TIROS WND	BEST TRACK		WIND DIFF	ZULU	STAGE	DIA	BND
	BEST	TRACK	SATELLITE				WND						
MARY	19.2N	134.8E	18.5N	135.0E	45	63	Formative Stages		--	150142	X	3.5	3
	21.1N	129.1E	20.0N	129.5E	66	85	135		-50	170223	X	4	4
	24.8N	120.9E	26.5N	122.0E	121	96	80		+16	190354	X	7	3
					*77								
OLIVE	25.5N	147.8E	26.0N	147.0E	55	101	130		-29	292209	X	5	4
	33.7N	146.2E	34.0N	146.0E	21	70	80		-10	312213	X	4	3
					*38								
POLLY	13.5N	118.4E	13.0N	122.0E	210	32	25		+07	301919	D	2	1
					*210								
ROSE	17.5N	124.9E	17.5N	125.0E	04	--	90		--	012258	-	-	-
	17.7N	124.3E	16.0N	124.0E	100	43	95		-52	020244	D	5	1
					*52								
SHIRLEY	16.2N	142.5E	17.5N	145.0E	165	--	20		--	040146	-	-	-
	19.0N	142.1E	21.0N	114.0E	162	54	20		+34	050115	X	4	2
	22.3N	137.1E	23.5N	137.0E	71	70	100		-30	070156	X	4	3
					*136								
TRIX	18.7N	136.6E	18.0N	136.0E	53	96	85		+11	120035	X	7	3
	20.7N	133.7E	20.5N	134.5E	37	80	100		-20	130058	X	5	3
	24.6N	129.6E	24.5N	129.0E	32	--	110		--	160035	X	-	4
	24.9N	129.9E	25.2N	129.8E	19	118	110		+08	160228	X	6	4
	30.8N	133.9E	32.0N	134.5E	81	77	100		-23	170200	X	4.5	3
					*44								
WENDY	13.3N	147.1E	14.5N	149.0E	130	25	25		0	180126	C	X	X
	21.7N	136.1E	21.0N	136.0E	44	25	35		-10	210138	C	X	X
	24.2N	132.6E	24.0N	133.5E	52	36	50		-14	230218	D	3	1
	27.2N	133.7E	29.0N	134.0E	109	40	45		-05	240150	D	4	1
	31.9N	138.5E	32.5N	139.0E	42	40	50		-10	250121	D	4	1
					*75								

\*AVG ERROR PER STORM

TABLE 3-1 (Cont'd)

CYCLONE	POSIT	POSIT	POSIT	TIROS	BEST	WIND	ZULU	STAGE	DIA	BNDS
	BEST TRACK	SATELLITE	ERROR	WND	TRACK	DIFF				
AGNES	17.5N 112.4E	17.0N 112.0E	36	36	45	-09	260300	D	3	1
	21.1N 112.2E	21.0N 113.0E	48	68	60	+08	270802	X	4	3
			*42							
BESS	15.6N 145.6E	15.5N 144.5E	54	60	70	-10	280128	X	5	2
			*54							
CARMEN	14.5N 148.9E	15.0N 149.0E	34	40	55	-15	010118	D	4	1
	23.3N 145.7E	24.0N 144.5E	80	135	150	-15	080130	X	7	4
			*57							
DELLA	26.6N 146.4E	26.0N 146.0E	42	88	75	+03	180133	X	5	3
			*42							
ELAINE	18.1N 112.6E	17.0N 113.0E	68	36	45	-09	110238	X	3	1
			*68							
FAYE	09.7N 147.2E	10.0N 147.0E	21	36	35	+01	200144	X	3	1
	10.8N 140.8E	10.8N 141.0E	13	53	75	-22	210215	X	2.5	3
	12.3N 135.6E	12.0N 134.0E	38	118	120	-02	220237	X	6	4
	14.3N 129.7E	15.0N 129.5E	30	135	130	+05	230157	X	7	4
			*26							

\*AVG ERROR PER STORM

TABLE 3-1 (Cont'd)



## G. THE STATISTICAL VERIFICATION PROGRAM

This program has been started to provide using agencies with a better measure of the accuracy of tropical storm forecasts and to help point out major sources of forecast errors. It is being run this year with hand computers, and will be programmed for the new CDC 3100 computer to be installed at Fleet Weather Central Guam later this year.

The program provides a breakdown of mean errors by latitude bands for 24, 48, and 72 hour forecasts, and also two measures of dispersion.

### 1. The root mean square (R.M.S.) of vector errors.

Assuming a circular normal distribution of errors, 63% of the forecasts made should verify within one R.M.S. of the actual storm position and 98% within two R.M.S. (See AWS Technical Report #164, dated August 1962).

### 2. The R.M.S. of right angle errors. (Equivalent in this case to the standard deviation)

Assuming a normal distribution, 68% of the forecasts should be within one R.M.S. right or left of the track and 95% within two R.M.S.

When the machine program becomes available, it is planned to include a breakdown of errors by quadrant in relation to the storm track. This will point out any consistent speed errors or consistent errors to right or left of track. Also, it is planned to specify whether the track is to the west or east of north to identify any consistent errors made before or after recurvature.

Since the R.M.S. of vector errors should be approximately 1.4 times the R.M.S. of right angle errors for a circular distribution, these two figures can be used as a check on the shape of the "error envelope", that is, to compare speed and track errors. Preliminary analysis of 1965 statistics (see table 3-2) indicate speed errors about 20% greater than track errors. More detailed analyses of this type are planned.

This program is expected to provide a better basis for command decisions involving tropical storms, and also to point out areas of maximum error so that they can be given top priority in developing forecast aids.

	1. R.M.S. OF VECTOR ERROR	2. .707 x R.M.S. OF VECTOR ERROR	3. STANDARD DEVIATION OF RIGHT ANGLE ERROR	PERCENT VARIATION ( $\frac{2-3}{2}$ )
<u>24 HOUR</u>				
TOTAL	182	129	103	20%
UNDER 20N	161	114	96	16%
20N-30N	162	115	98	15%
ABOVE 30N	263	186	130	30%
UNDER 35N	170	120	100	17%
ABOVE 35N	295	209	142	32%
<u>48 HOUR</u>				
TOTAL	358	253	211	17%
UNDER 20N	314	222	189	15%
20N-30N	333	235	214	09%
ABOVE 30N	469	332	239	28%
UNDER 35N	340	240	212	12%
ABOVE 35N	499	253	204	19%
<u>72 HOUR</u>				
TOTAL	494	349	294	16%
UNDER 20N	397	281	254	10%
20N-30N	463	327	294	10%
ABOVE 30N	627	443	333	25%
UNDER 35N	451	319	295	08%
ABOVE 35N	760	537	284	47%

42

TABLE 3-2

#### H. FINAL REPORT ON 700MB NUMERICAL GRID

The 700mb numerical grid forecast (See 1964 Annual Typhoon Report) was tested on a total of six storms, using four different smoothing techniques. It was found that, with the data available, no significant objective rules could be developed. Since the present upper air and reconnaissance coverage makes an objective analysis practically impossible, this project has been dropped for the present. With an increase in coverage, especially in the area south of 20N, this might still become a useful objective forecasting tool.

## I. CHANGES IN SEA SURFACE TEMPERATURE (SST) RESULTING FROM THE TRANSIT OF TYPHOONS SHIRLEY AND TRIX

Typhoons SHIRLEY and TRIX originated and intensified to typhoon strength over warm tropical waters ( $\sim 86^{\circ}\text{F}$ ) of the Western Pacific. The tracks of the typhoons (shown by dashed lines) were seldom farther than 150 miles apart during their transit. The combined effect from the winds along these tracks was a quantitative change in sea surface temperature (figure 3-12) between the mean temperature pattern of 1-5 September (figure 3-10) and that of 21-25 September (figure 3-11).

Although the typhoon tracks traversed an area of fairly sparse data during the first three days, a definite drop of sea surface temperature greater than  $5^{\circ}\text{F}$  was observed. This decrease of sea surface temperature is believed to be primarily the result of wind mixing of the surface water with the cooler water from below the relatively shallow isothermal layer of 100 to 200 feet.

The typhoons recurved to be a more northerly track in the area of the warmer Kurishio current. Again relatively shallow mixed layer depths (MLD) were encountered (figure 3-13) and wind mixing is considered the primary factor in producing cooler sea surface temperature of greater than  $5^{\circ}\text{F}$ .

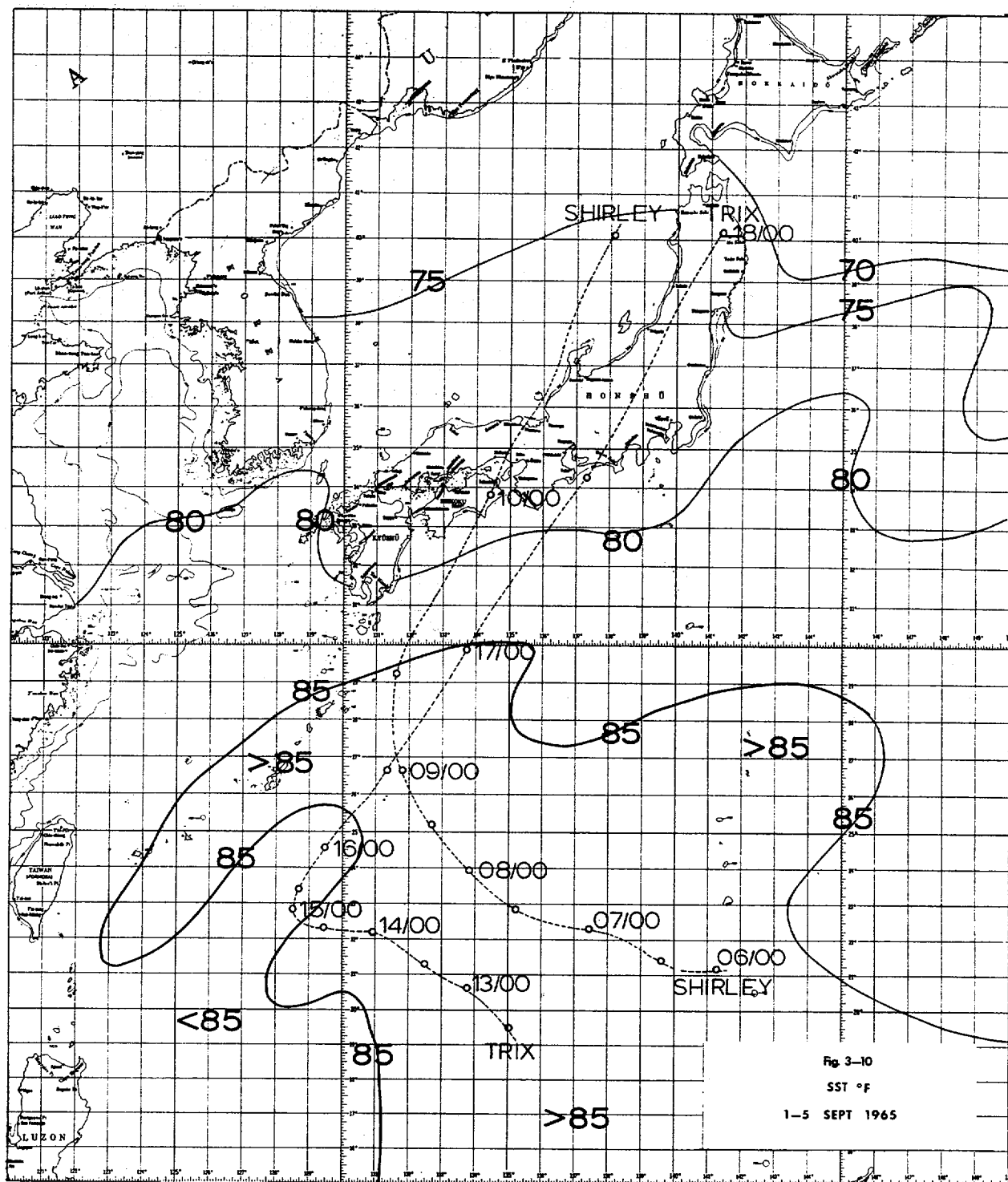
Additional factors which contribute to the decrease of sea surface temperature are:

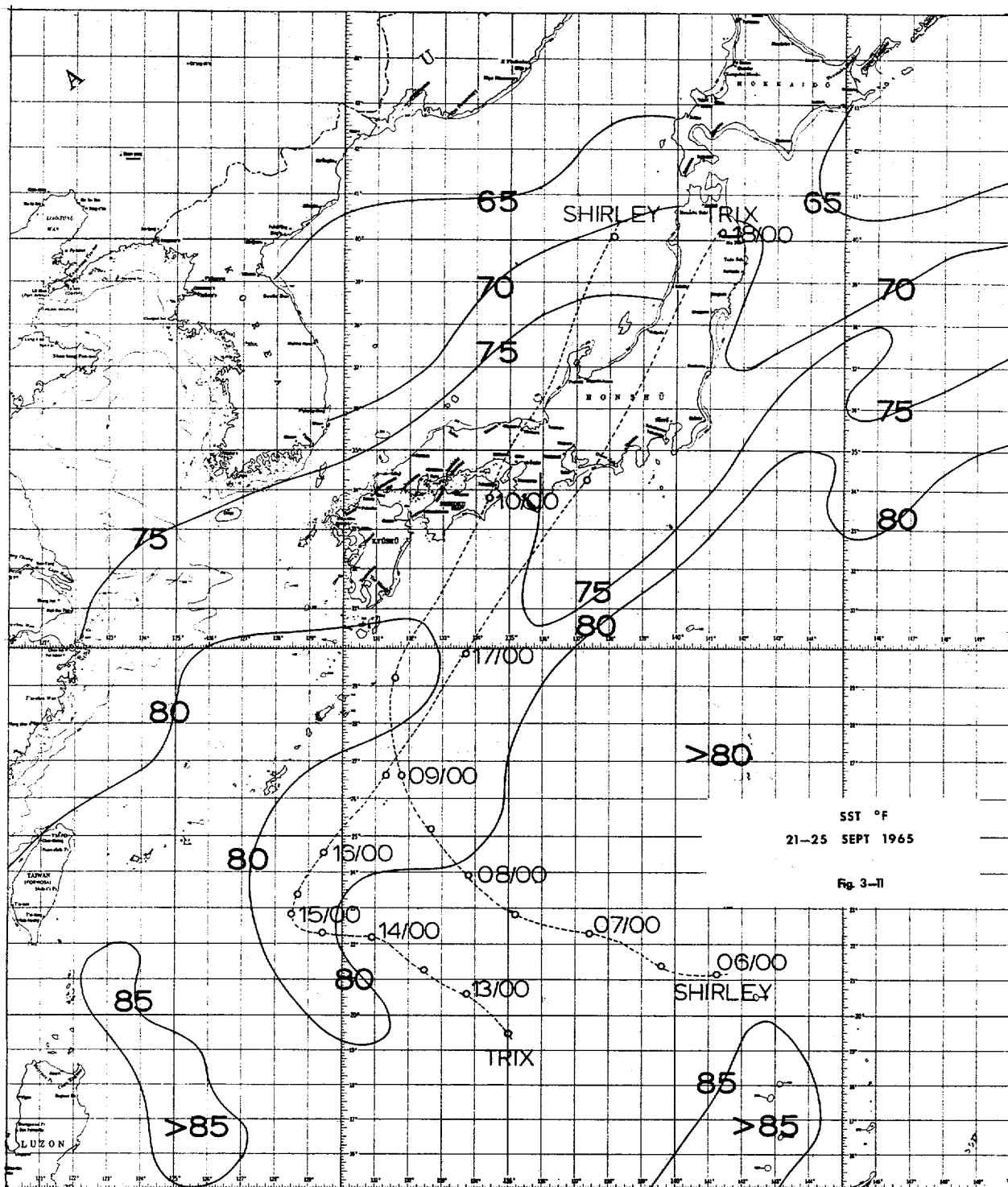
1. The decrease of incoming solar radiation due to increased cloud cover.
2. The presence of cooler water by precipitation.

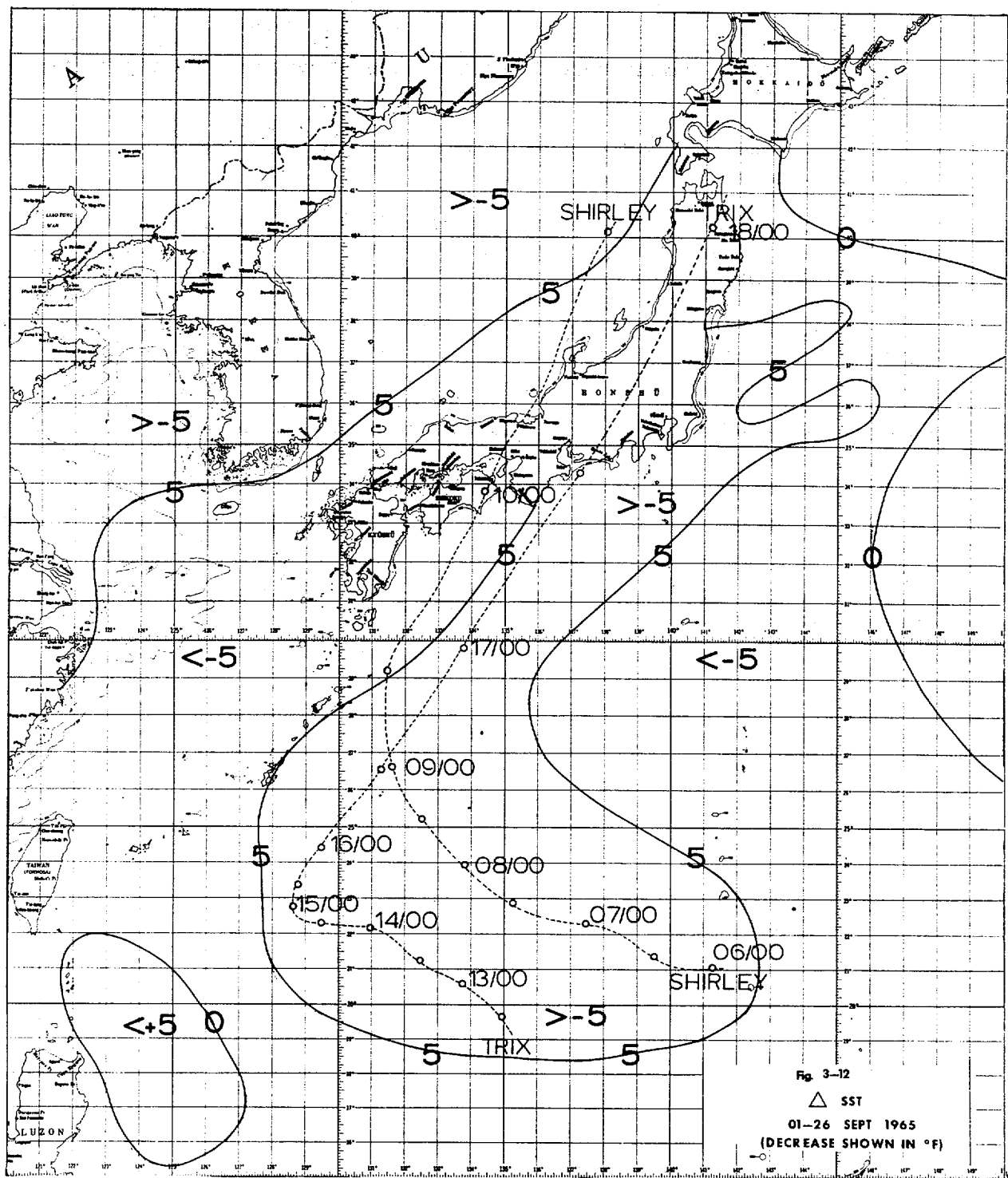
The latter process being more noticeable in lower latitudes where a greater difference exists between sea surface temperature and the precipitation temperature.

It appears evident that the passage of a typhoon over an area will result in a cooling effect on sea surface temperature. The amount of cooling being dependent upon the intensity of the typhoon, typhoon speed, and other factors previously mentioned.

Further research into the effects of typhoons upon the sea surface may result in a prediction method for determining the quantitative cooling in an area under their influence.







3. 700mb temperature in center rises temporarily - may be as much as 6 degrees.

4. Winds at surface near the center decrease rapidly. (Also winds at 700mb, although to a lesser extent).

5. Surge found both at surface and 700mb on nose of cold air tongue 100-200 miles from the center. Secondary surge on nose of warm air tongue 150-250 miles from center.

6. Cold air at 700mb moves around west, south and east quadrants of storm as a tongue approximately 75 miles wide centered about 100 miles from the center. The warm air is cut off as a pocket over the center and gradually driven aloft. (The system becomes extratropical with all the characteristics of a fully developed warm type occlusion.)

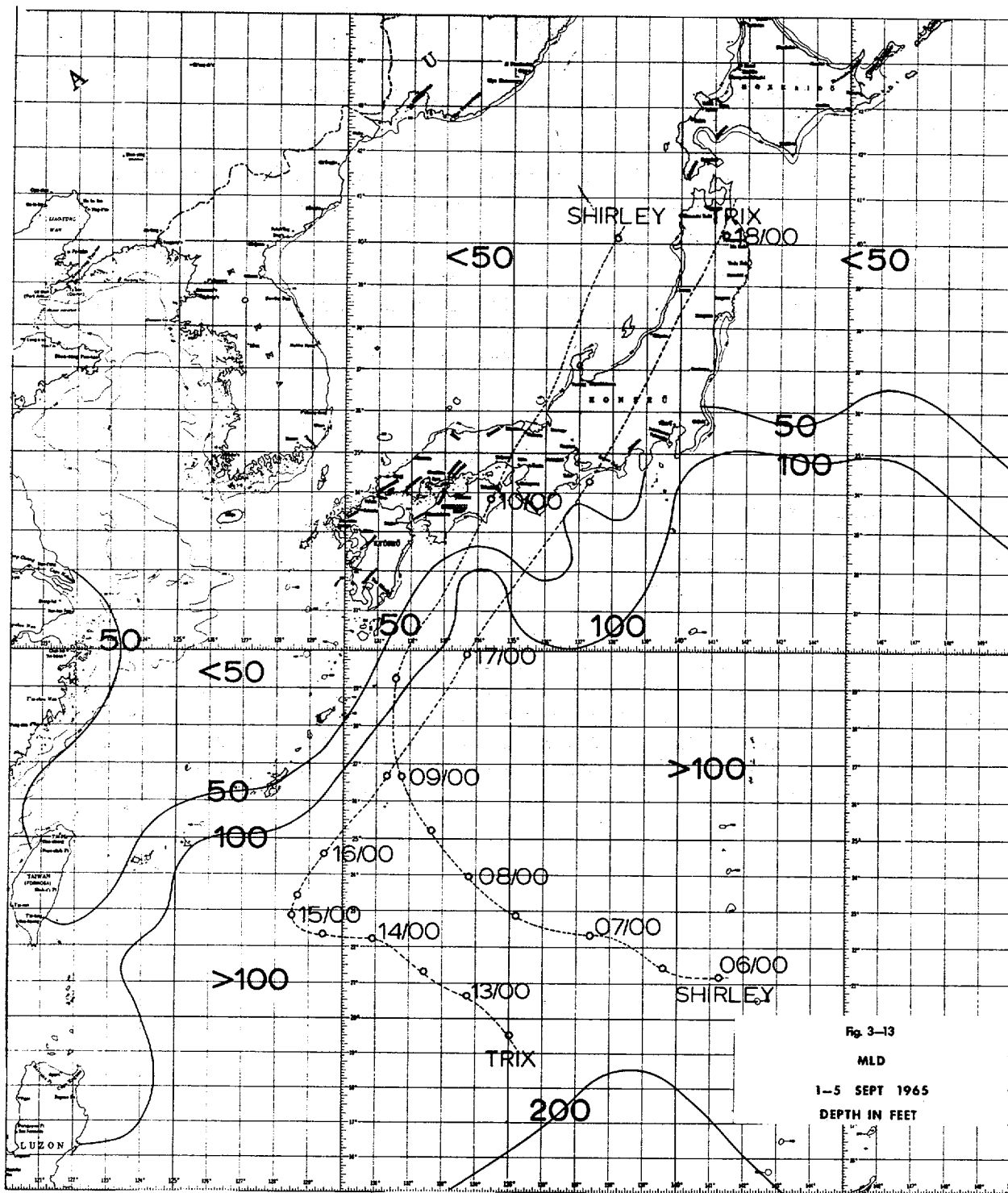


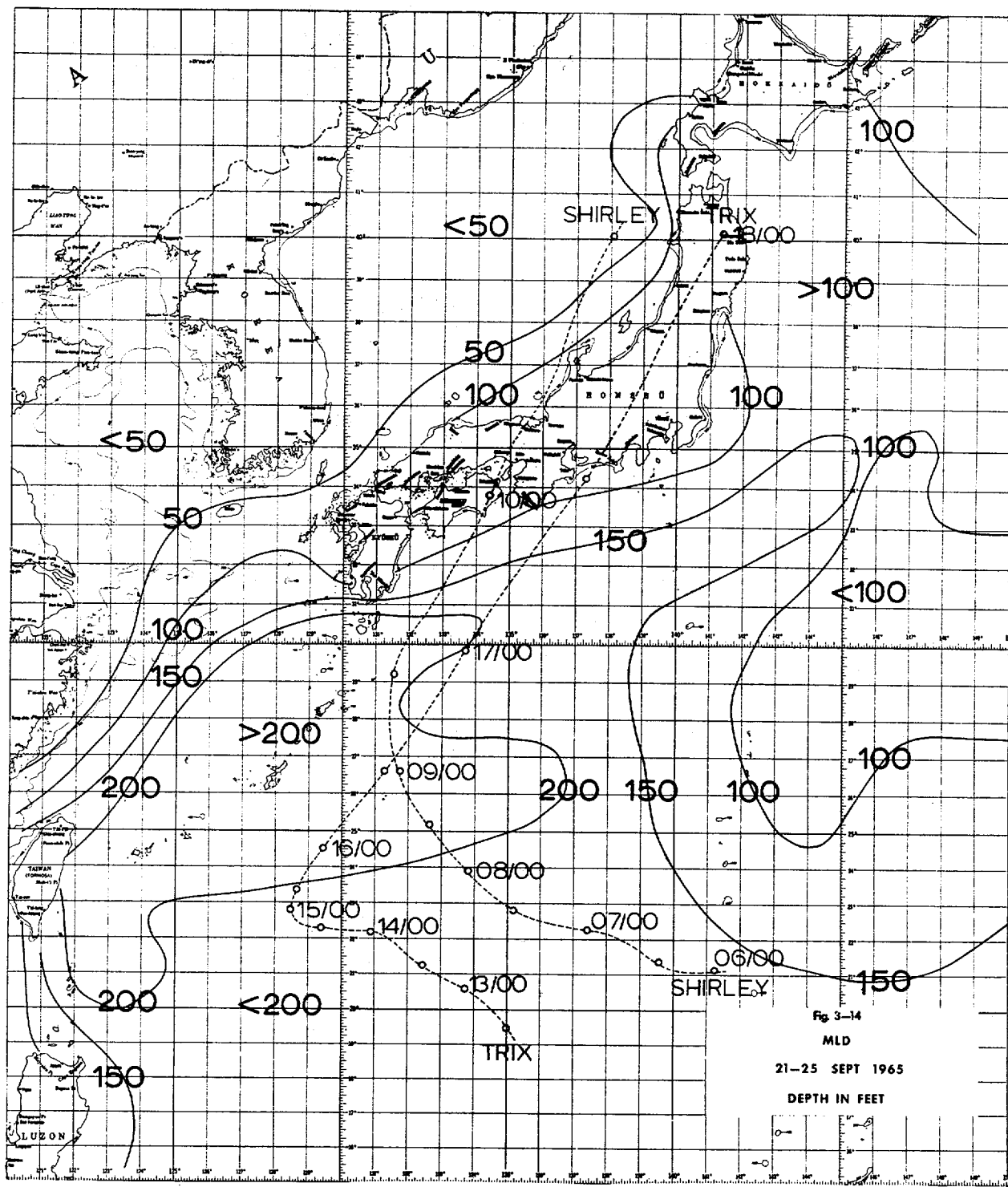
J. CHANGES IN MIXED LAYER DEPTH (MLD) RESULTING FROM THE TRANSIT OF  
TYPHOONS SHIRLEY AND TRIX

Typhoons SHIRLEY and TRIX attained typhoon intensity in waters having a mixed layer depth of approximately 200 feet and transited over water of continually decreasing mixed layer depth. Within twenty four hours of travel along their tracks, the typhoons appear to have caused an increase in mixed layer depth (figure 3-15), as relatively shallow initial layer depths were encountered. Figure 3-15 illustrates deepening of the mixed layer depth in increments of 50 feet from the original conditions (figure 3-13) and those subsequent to the passage of SHIRLEY and TRIX through the area. (figure 3-14)

Greater horizontal gradients of mixed layer depth are encountered upon reaching the Kurishio Region where 50 to 100 foot mixed layer depth is encountered. The combination of increased wind intensity and the proportionally deeper wind mixing effect over an area of initially relatively shallower layer depths accounts for the greater change depicted in figure 3-15. It may be noted that the mixed layer depth generally increased between 50 and 100 feet throughout the area affected by the typhoons.

During the period of 1 to 26 September there appeared to be a general deepening of the mixed layer depth in the Kurishio Current region (figure 3-15). Although other factors were undoubtedly contributory in this increase, it is believed that wind mixing was the primary influence. It is conceivable that the change in mixed layer depth may be predicted given accurate wind intensities, typhoon movement, existing mixed layer depth and the thermocline gradient in a given area.





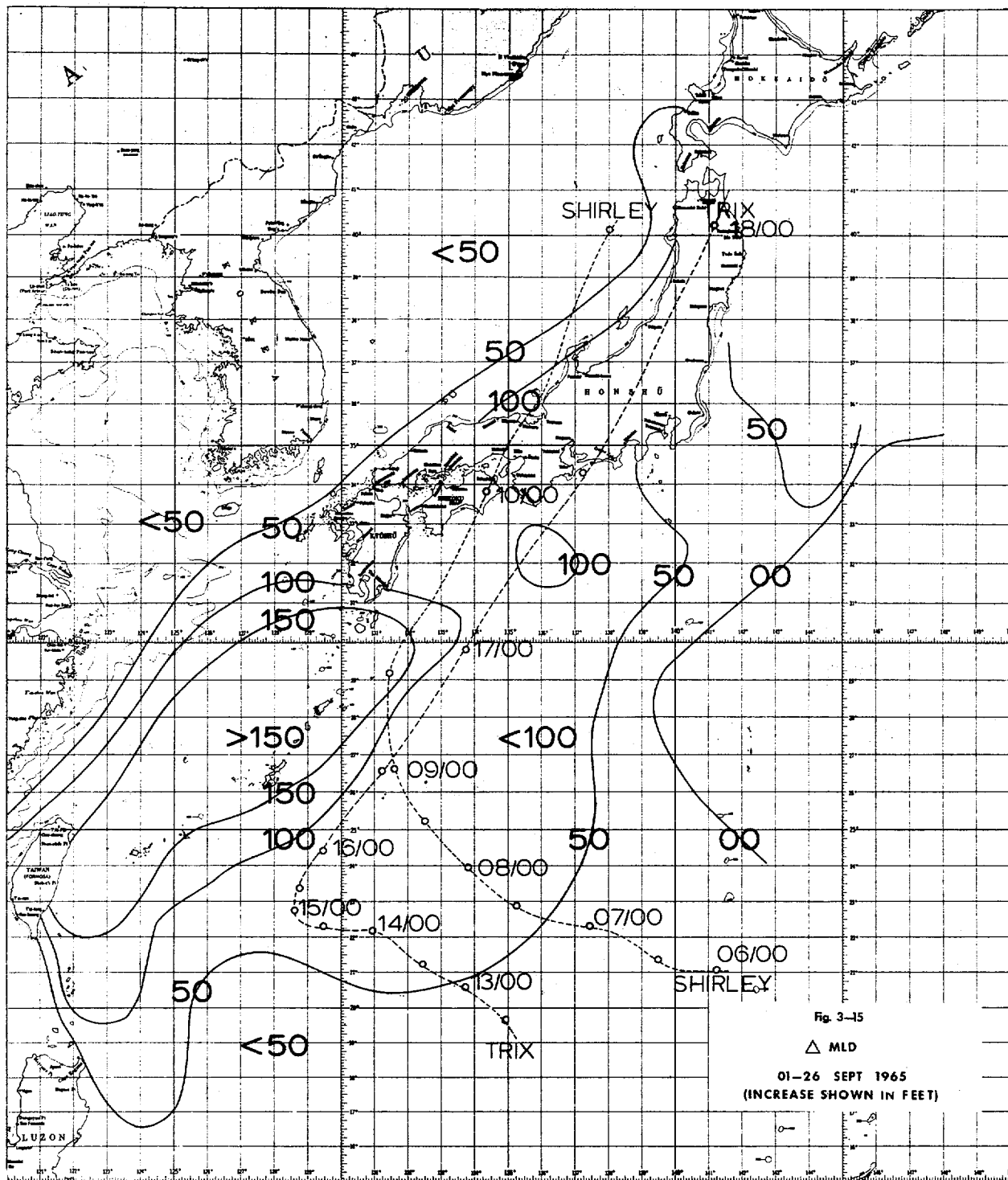


Fig. 3-15

△ MLD

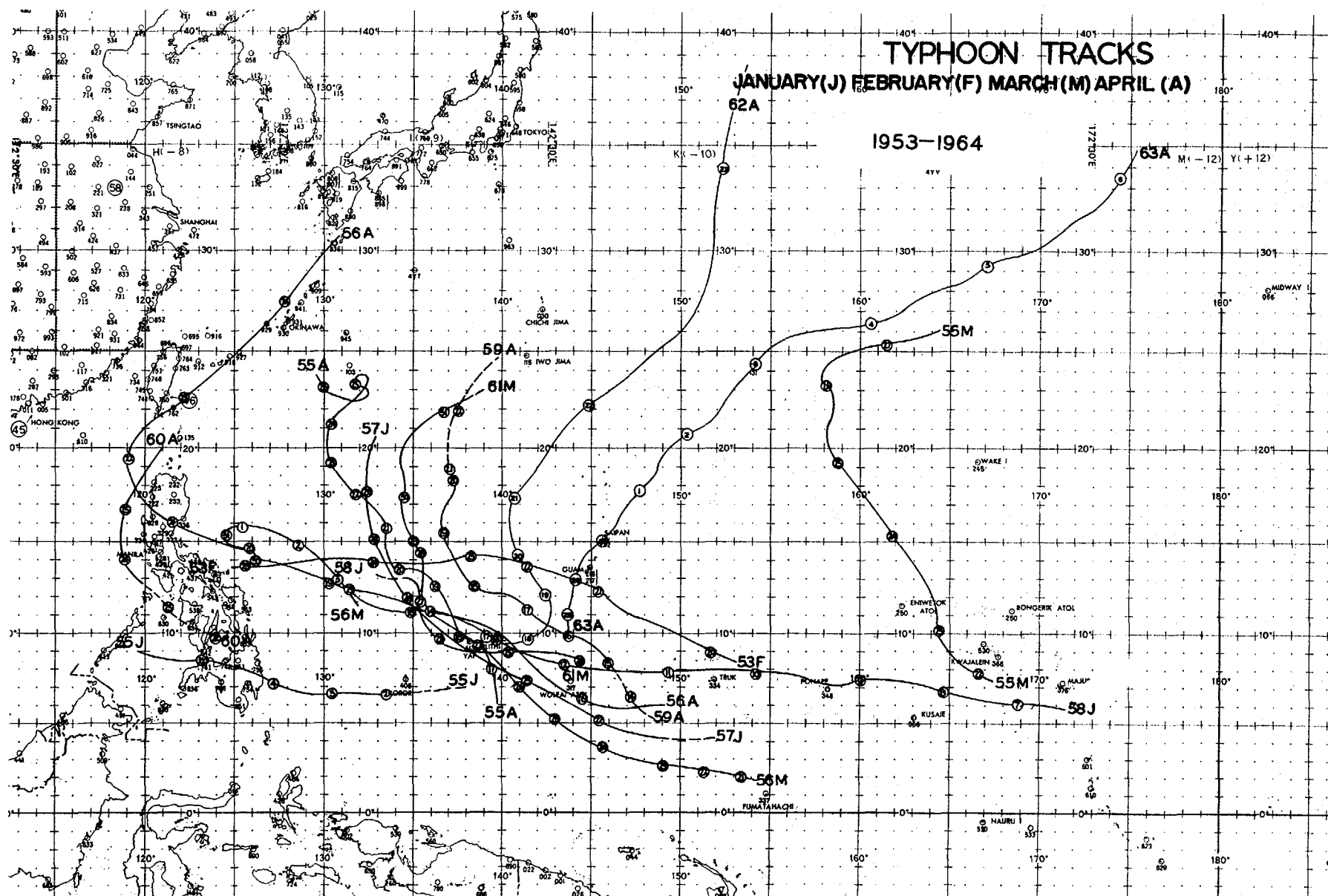
01-26 SEPT 1965  
(INCREASE SHOWN IN FEET)

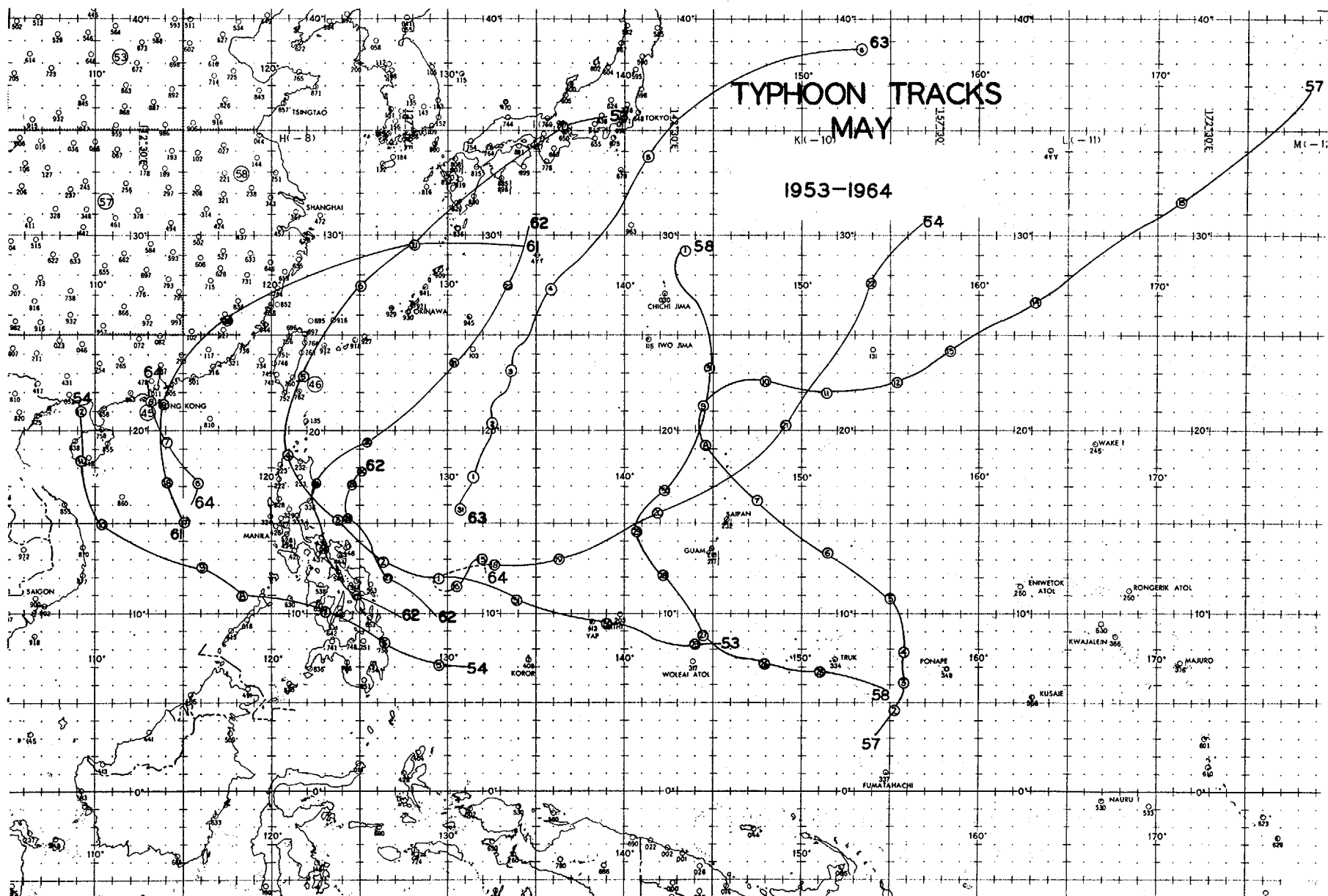
**TYPHOON TRACKS**

**1953 - 1964**

JANUARY (J) FEBRUARY (F) MARCH (M) APRIL (A)

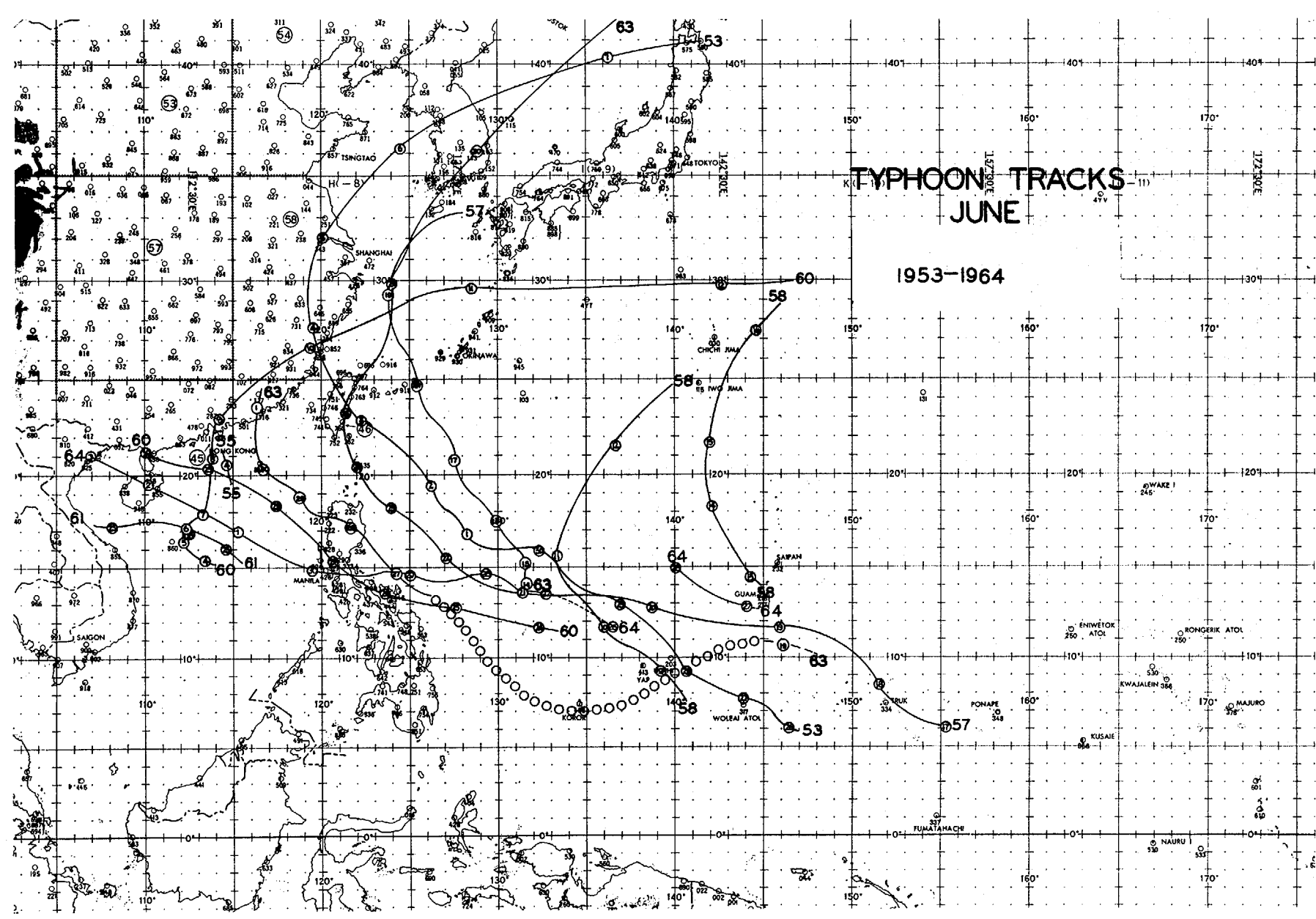
M(-12)	Y(+12)
--------	--------



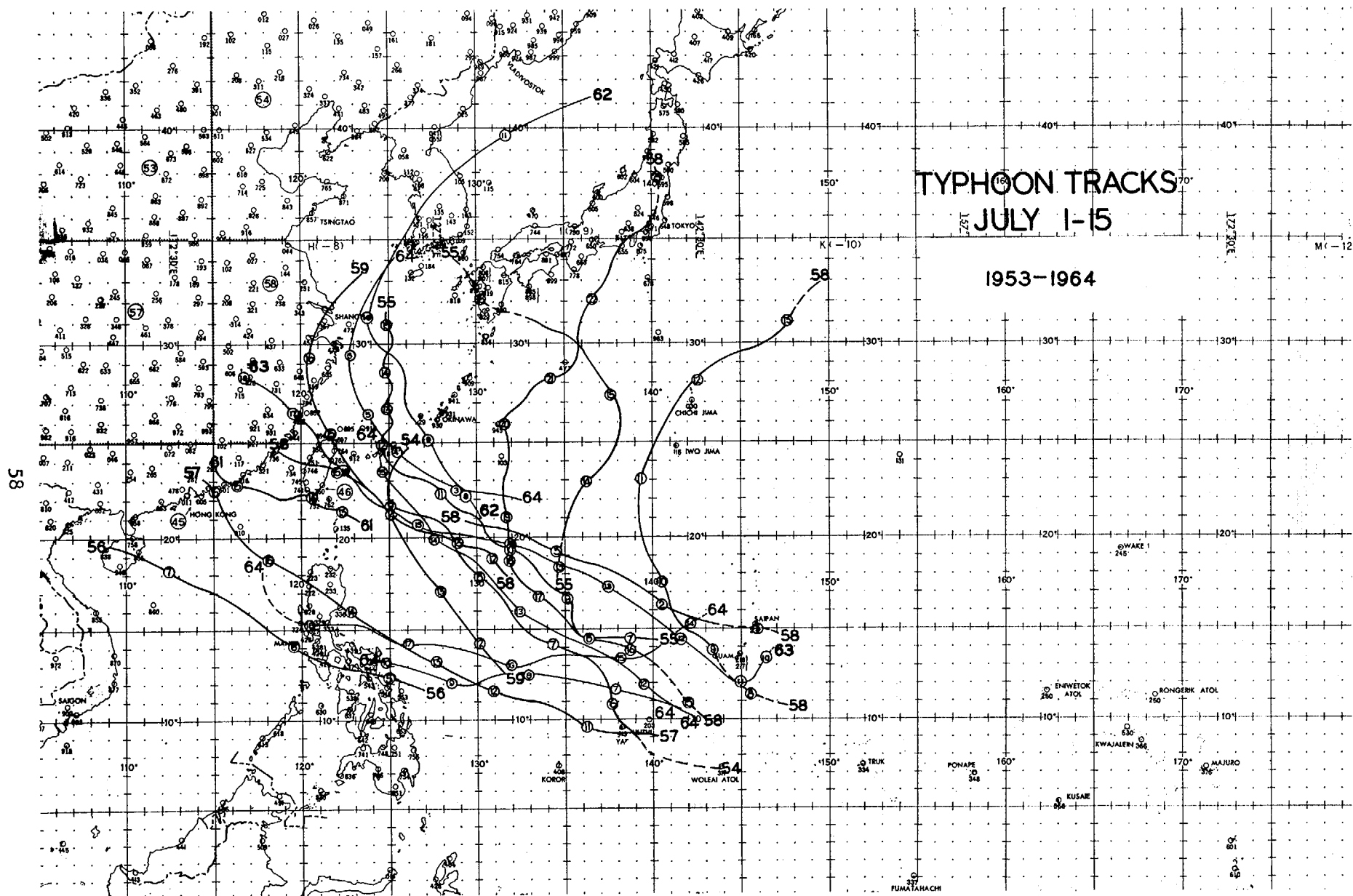


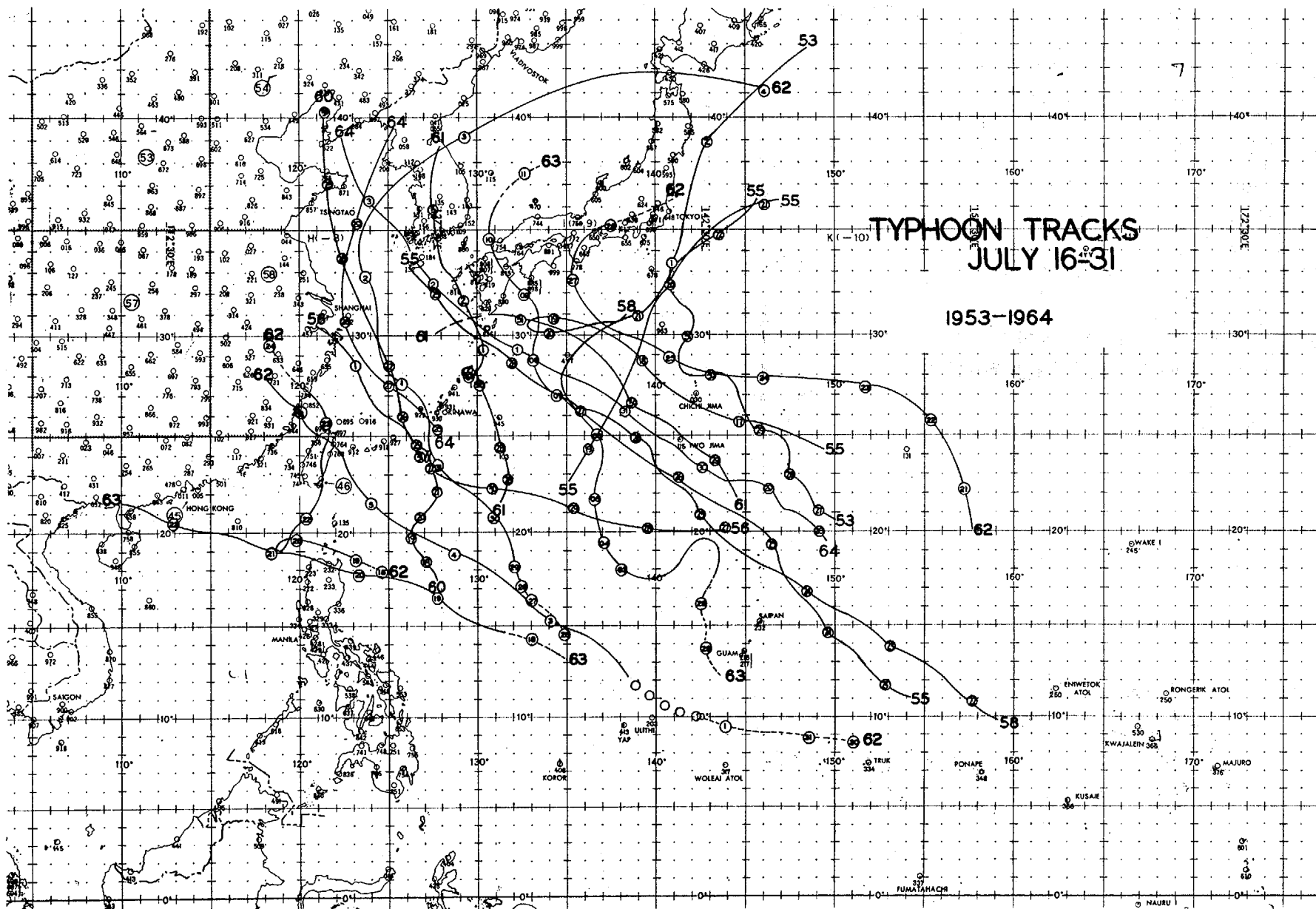
# TYPHOON TRACKS JUNE

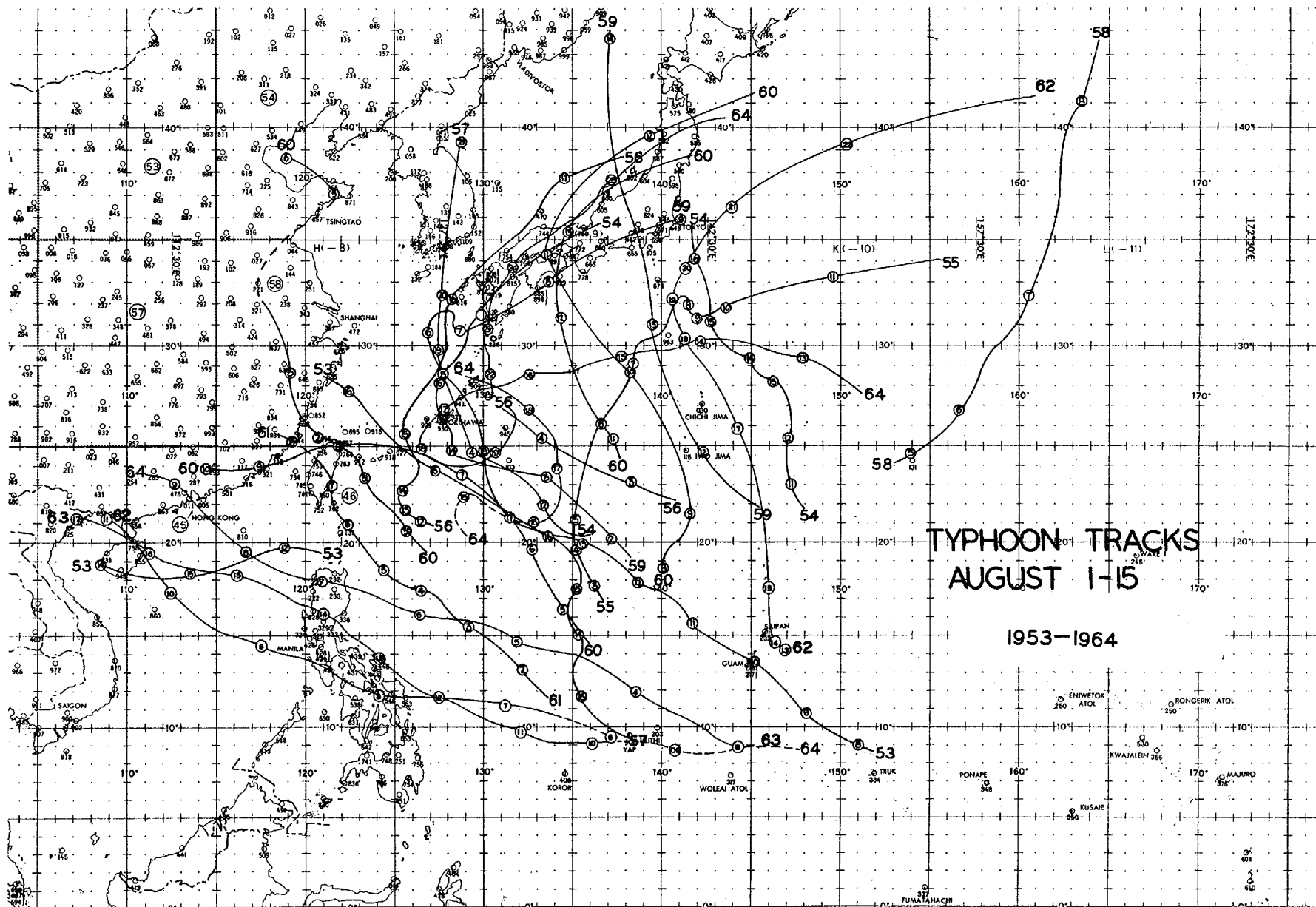
1953-1964

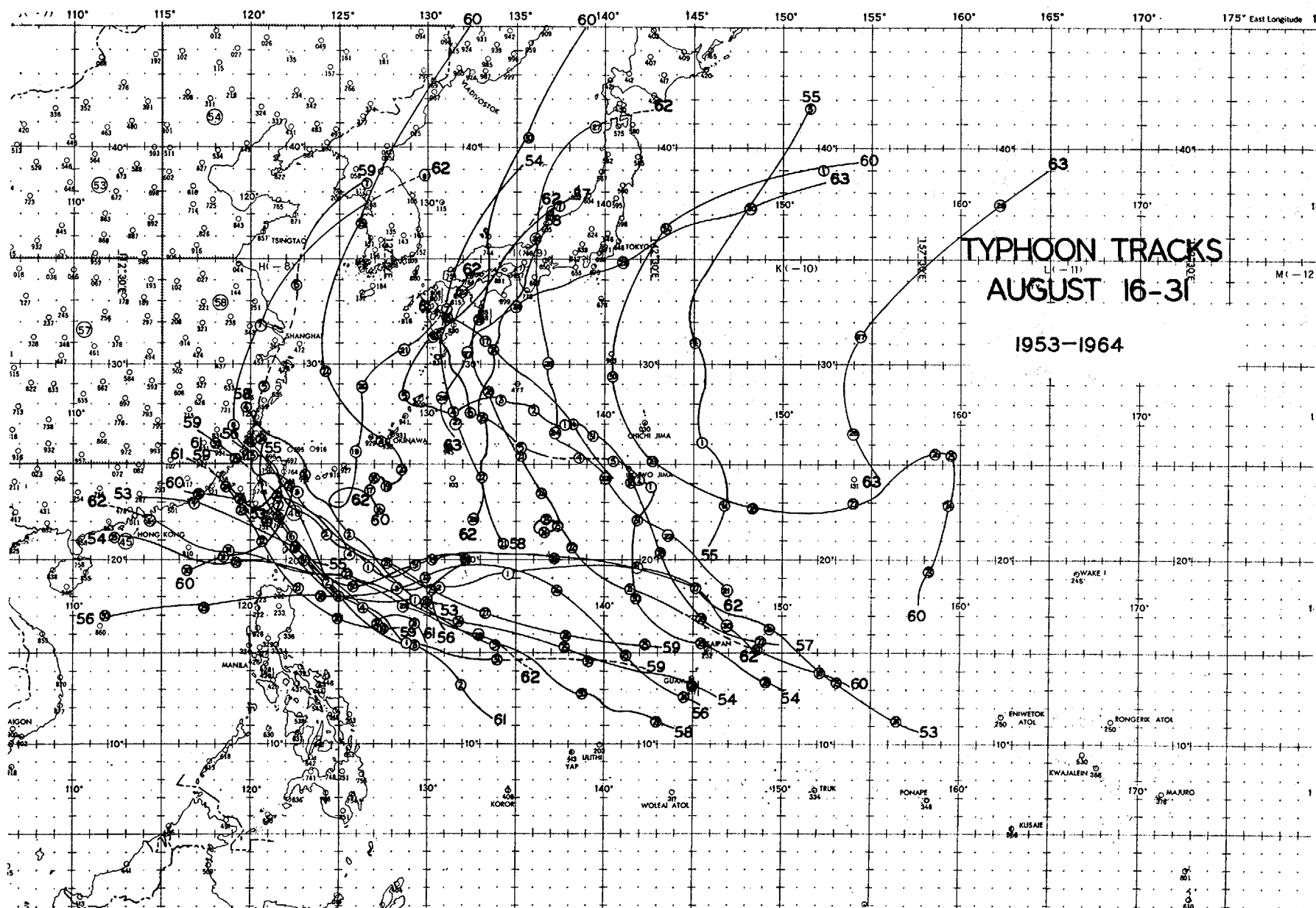


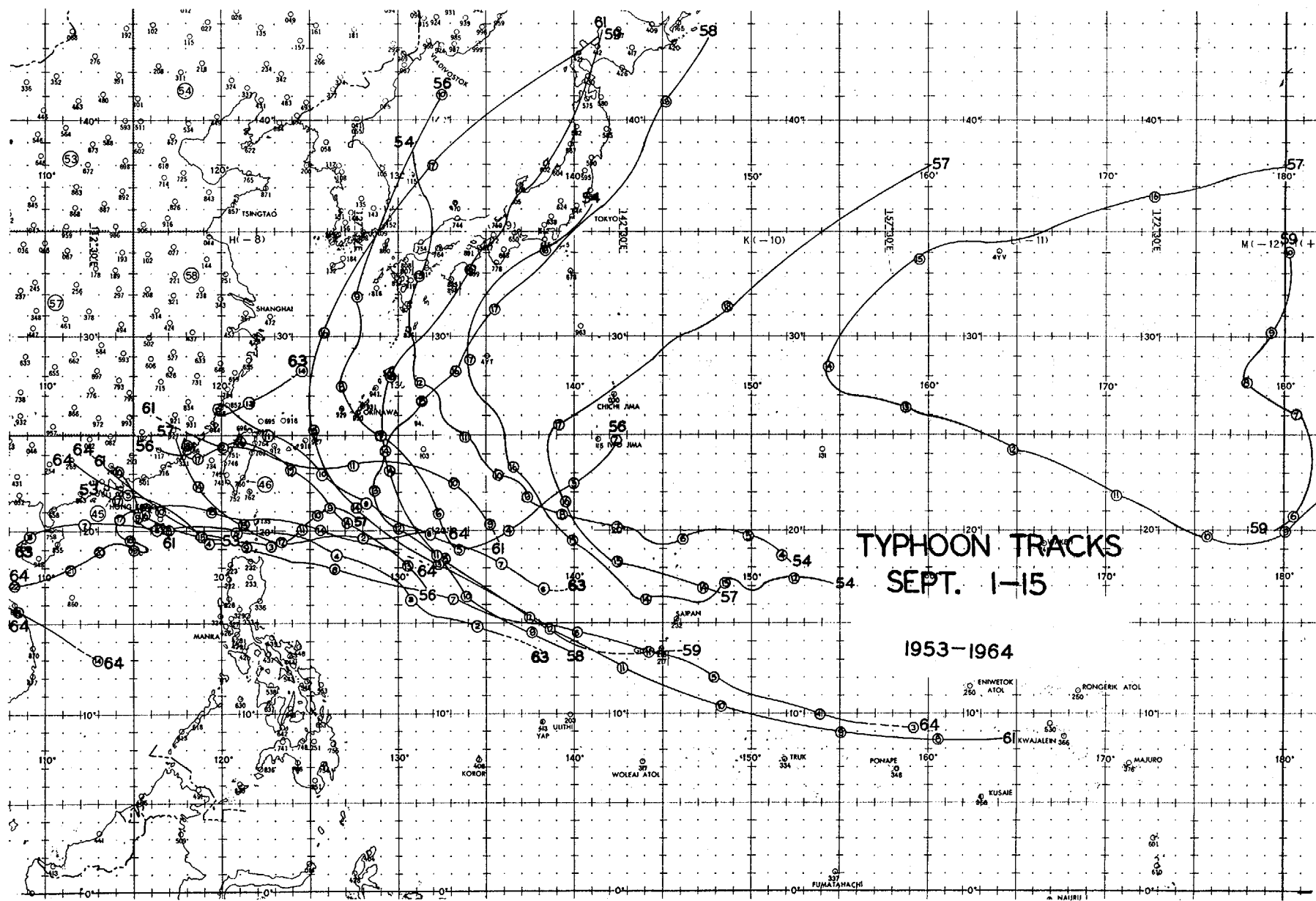


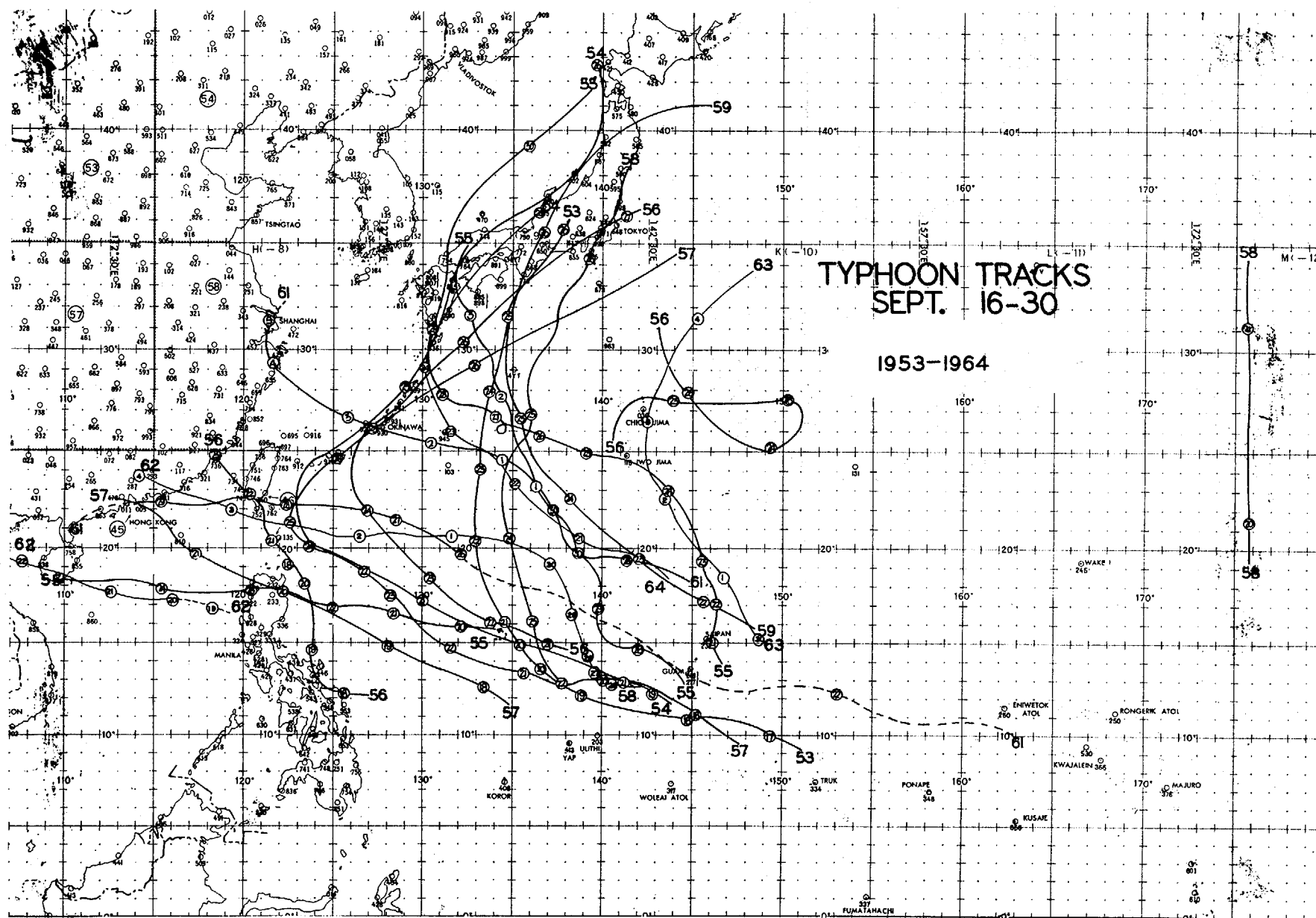


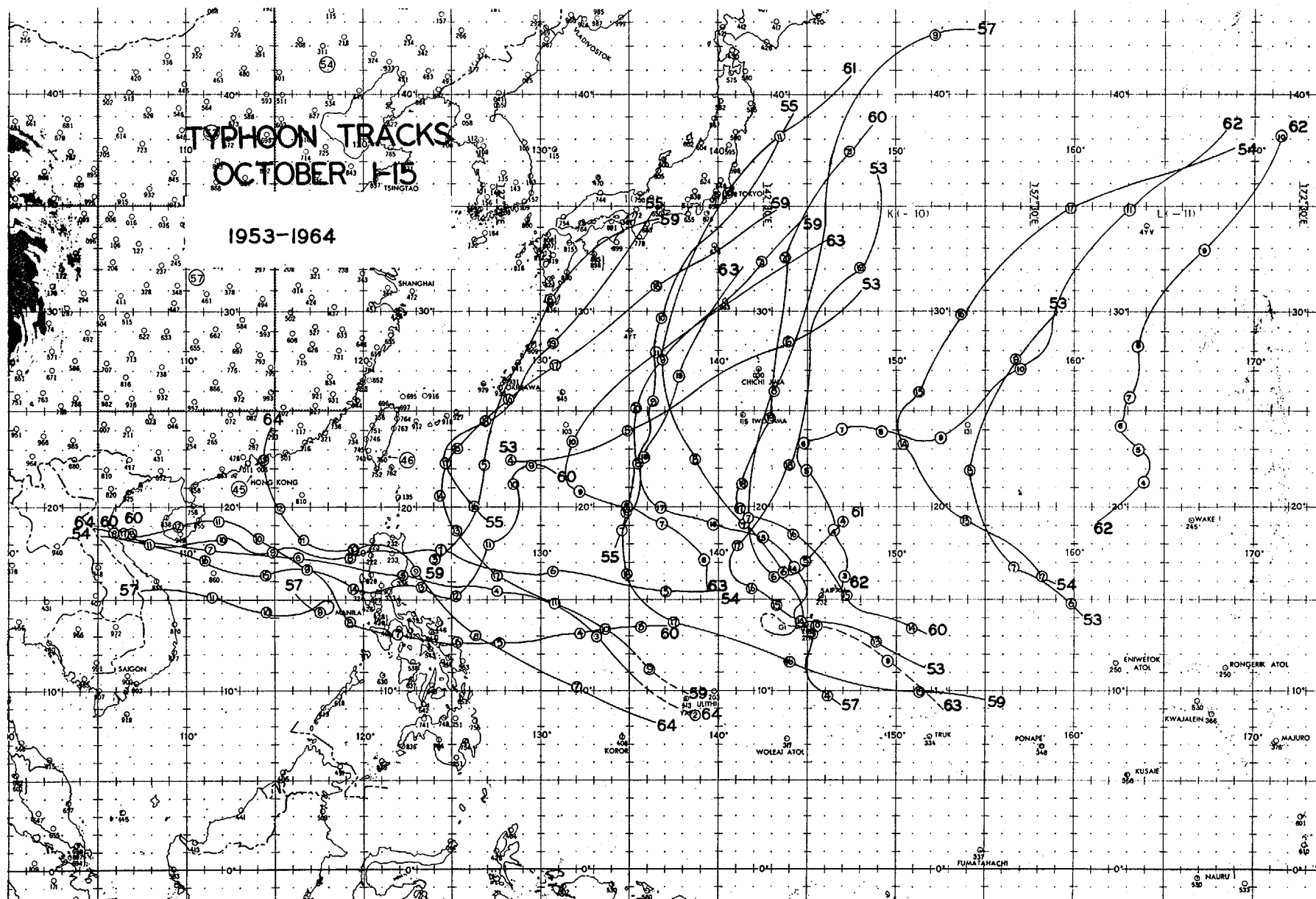






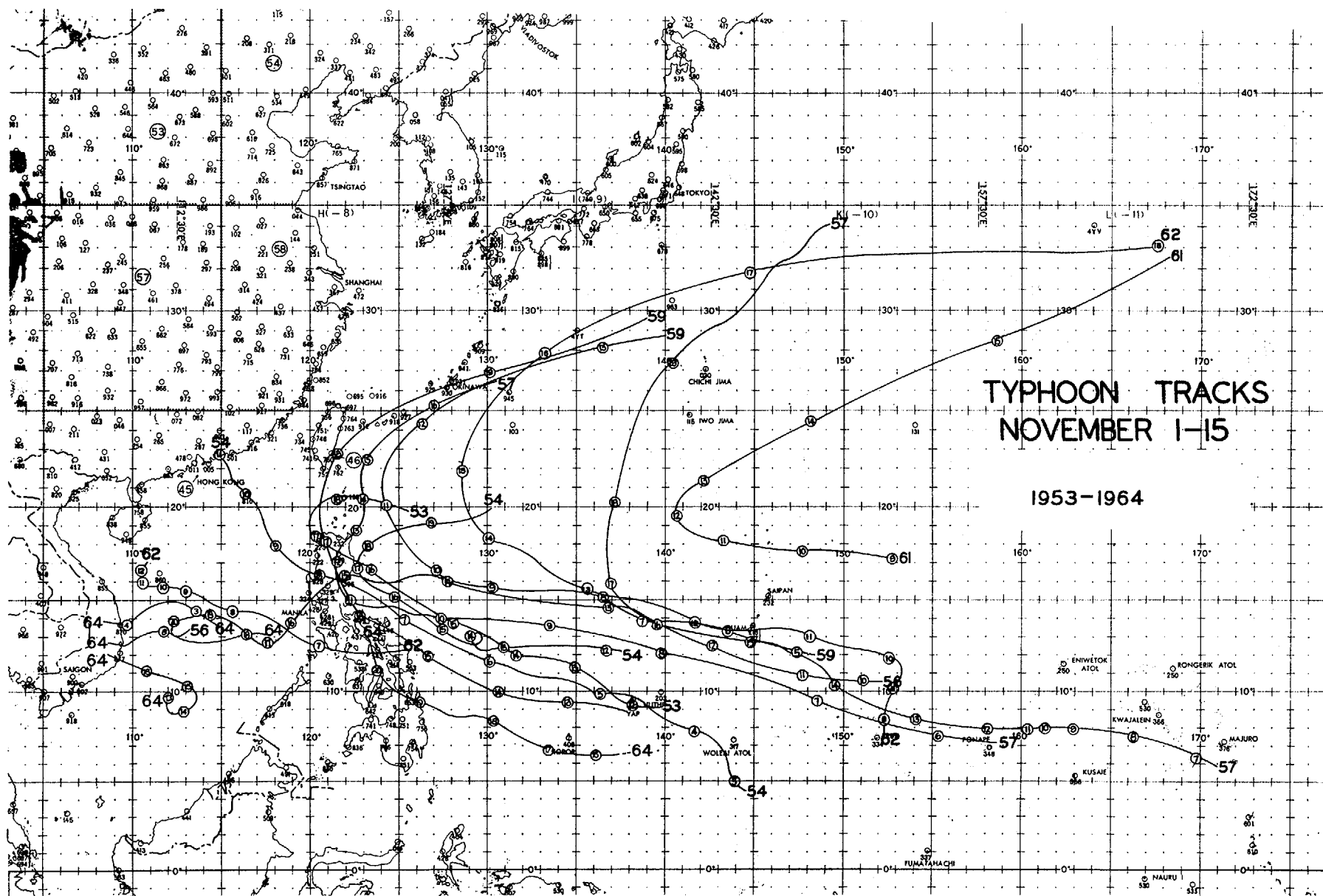


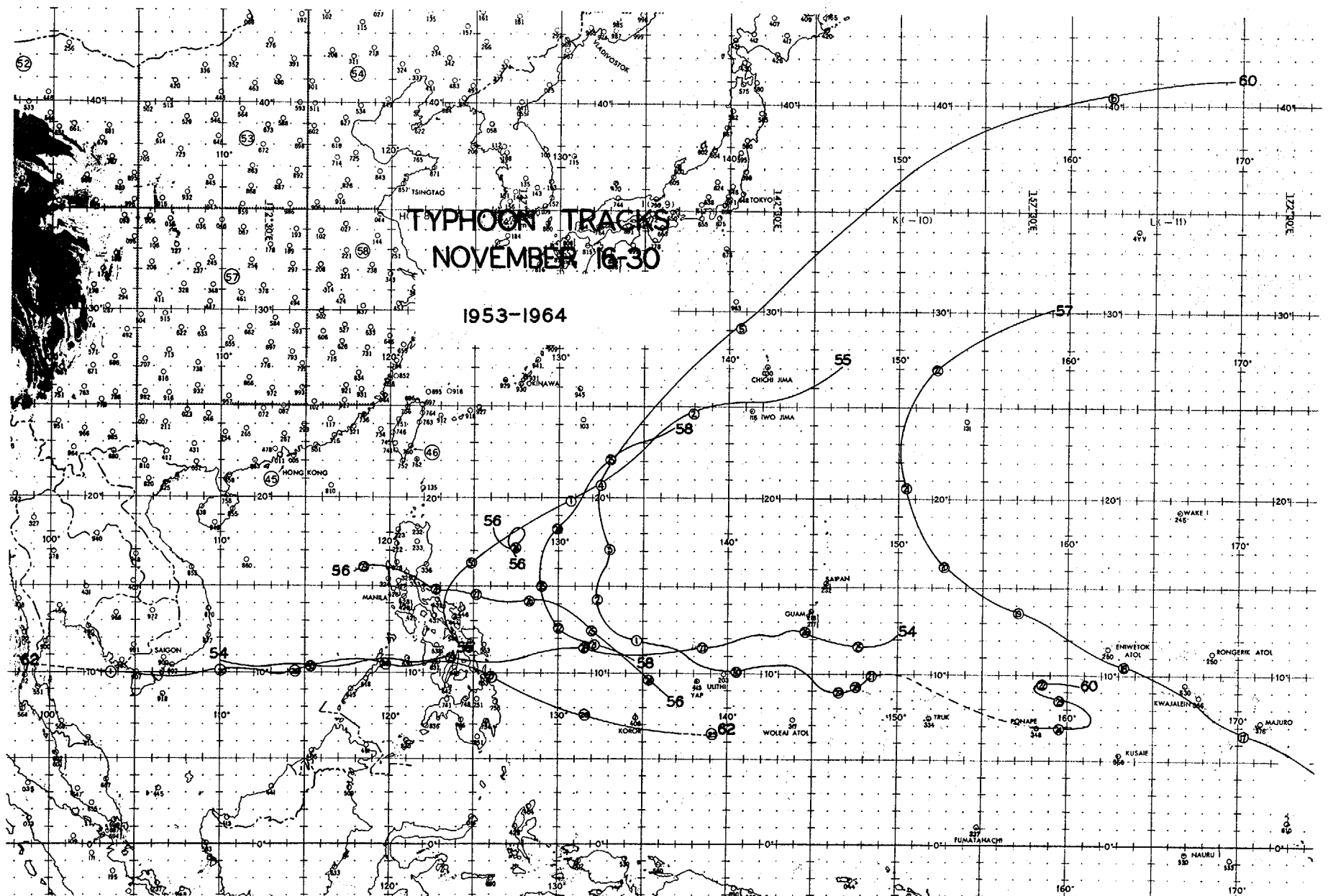


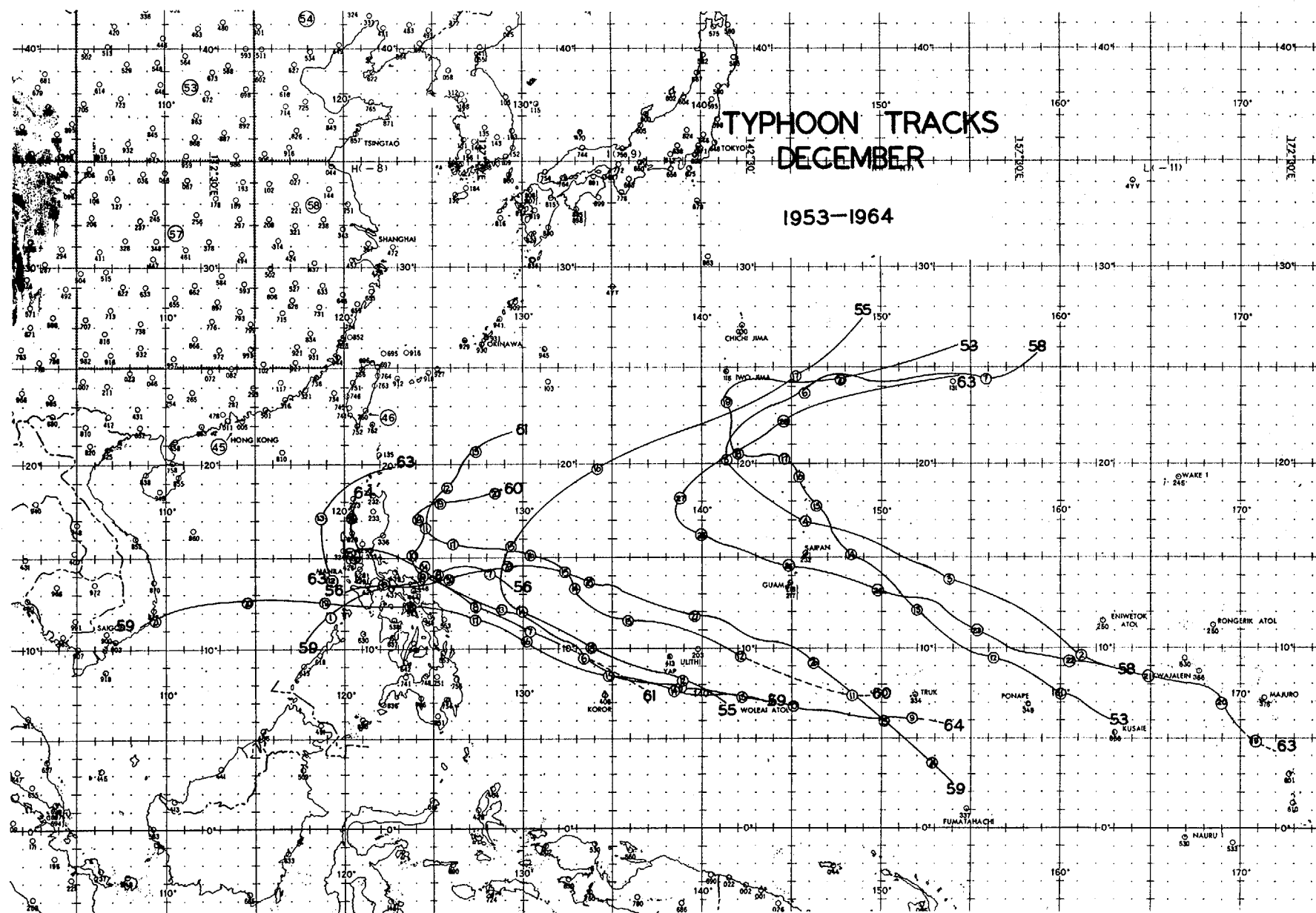












TYPHOON DISTRIBUTION BY MONTH

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOT
1952						3	1	3	3	5	3	3	21
1953		1			1	1	1	5	2	4	1	1	17
1954					1		1	4	4	2	3		15
1955	1		1	1		1	5	3	3	2	1	1	19
1956			1	1			2	4	5	1	3	1	18
1957	1			1	1	1	1	2	5	3	3		18
1958	1				1	2	5	3	3	3	1	1	20
1959				1			1	5	3	3	2	2	17
1960				1		2	2	8		4	1	1	19
1961			1		2	1	3	3	5	3	1	1	20
1962				1	2		5	7	2	4	3		24
1963				1	1	2	3	3	3	4		2	19
1964					2	2	6	3	5	3	4	1	26
1965	1			1	2	2	4	3	5	2	1		21
AVG.	.29	.07	.21	.57	.93	1.2	2.9	4.0	3.4	3.1	1.9	1.0	19.6

## CHAPTER IV

### SUMMARY OF TROPICAL CYCLONES 1965

The Joint Typhoon Warning Center issued a total of 805 tropical warnings on 21 Typhoons, 13 Tropical Storms and 6 Tropical Depressions in the Western Pacific Ocean in 1965. The previous record of 165 calendar days in warning established in 1961 was broken this year with JTWC spending 167 calendar days in warning. During this time 2 or more tropical cyclones were carried on 55 days with 3 tropical cyclones carried on 10 of these.

The following data for the JTWC area of responsibility is presented for comparison:

#### COMPARATIVE WESTERN PACIFIC TROPICAL CYCLONE DATA

	<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>
TOTAL NUMBER OF WARNINGS	583	776	738	815	663	730	805
CALENDAR DAYS OF WARNING	137	157	165	154	146	153	167
SUSPECT CYCLONES*	32	26	27	17	5	7	-
TROPICAL DEPRESSIONS	7	3	11	9	3	5	6
TROPICAL STORMS	9	8	11	6	6	14	13
TYPHOONS	17	19	20	24	19	26	21
TOTAL TROPICAL CYCLONES*	65	56	69	56	33	52	40

\*Investigative flights were not assigned cyclone numbers during 1965 as had been done in the past.

In the area of the North Pacific Ocean east of 180° warnings were issued on a total of 12 tropical cyclones of which one, Tropical Storm DOREEN, moved into the area between 140°W and 180°. (See Annex A).

1965 was also a record year for "Super Typhoons" (maximum sustained surface winds of 130 knots or greater). A total of 11 typhoons were classified as "Super Typhoons". The most intense storm of 1965 was Typhoon DINAH (10 June - 19 June) with a maximum sustained surface wind of 160 knots.

#### NUMBER OF SUPER TYPHOONS BY YEAR

<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>
8	4	6	6	8	6	11

Another example of the Fujiwhara Effect occurred during 1965. The Fujiwhara Effect was observed between Typhoons JEAN and IVY in the Philippine Sea during the period 29 July through 1 August. JEAN became the predominate system and absorbed IVY on 1 August.

A study was made (see Chapter III) on the rapid movement of some typhoons prior to becoming extratropical. The best example of this phenomenon was Typhoon FAYE which reached a maximum forward speed of 65 knots on 26 November 1965, six hours prior to becoming extratropical. AMY, JEAN, TRIX and CARMEN were other typhoons that reached forward speeds of 40 knots or more as much as 18 hours prior to becoming extratropical.

The 24, 48 and 72-hour mean forecast error for each typhoon was computed by two methods. In addition to the standard mean vector forecast error table shown below, a computation of closest-distance error from best track has been included for comparison. This error computation is based on the closest right angle distance of the forecast position to the best track without regard to time. Possibly this will give the user a better understanding of the ability of JTWC to forecast the effects of a typhoon on one particular area.

The following tabulation of the forecast vector error for the past 16 years is given for comparison:

FORECAST VERIFICATION  
AVERAGE ERROR NAUTICAL MILES

	24 HR	48 HR	72 HR
1950-58	170	---	---
1959	117	267	---
1960	177	354	---
1961	136	274	---
1962	144	287	476
1963	127	246	374
1964	133	284	429
1965	151	303	418

# 1965 FORECAST VECTOR ERRORS\*

TYPHOON	24 HR FORECASTS		48 HR FORECASTS		72 HR FORECASTS	
	NO. OF CASES	MEAN ERROR	NO. OF CASES	MEAN ERROR	NO. OF CASES	MEAN ERROR
PATSY	10	213	6	511	--	--
WANDA	6	99	2	280	--	--
AMY	17	210	13	417	8	677
BABE	16	164	12	340	5	437
CARLA	4	151	--	--	--	--
DINAH	26	87	20	136	16	161
FREDA	29	146	25	271	18	371
HARRIET	17	186	13	380	8	576
IVY	13	233	8	541	3	1054
JEAN	24	128	20	276	16	373
LUCY	29	169	25	329	19	481
MARY	14	107	10	154	5	170
OLIVE	17	138	13	284	9	449
ROSE	15	55	11	127	3	245
SHIRLEY	16	231	12	589	3	871
TRIX	27	138	23	302	18	426
VIRGINIA	11	289	7	615	3	1055
BESS	26	106	22	256	16	401
CARMEN	21	148	15	238	11	289
DELLA	23	152	17	277	11	484
FAYE	44	148	40	268	36	370

AVERAGE ERROR - 24 HR FORECASTS (405 CASES)... 151 MI

AVERAGE ERROR - 48 HR FORECASTS (314 CASES)... 303 MI

AVERAGE ERROR - 72 HR FORECASTS (208 CASES)... 418 MI

\*Includes Forecast Vector Errors during tropical storm intensity



1965 FORECAST ERRORS\*  
(IN TERMS OF CLOSEST DISTANCE TO BEST TRACK)

TYPHOON	24 HR FORECASTS		48 HR FORECASTS		72 HR FORECASTS	
	NO. OF CASES	MEAN ERROR	NO. OF CASES	MEAN ERROR	NO. OF CASES	MEAN ERROR
PATSY	10	91	6	327	--	--
WANDA	6	70	2	125	--	--
AMY	17	80	13	198	8	353
BABE	16	100	12	241	5	320
CARLA	4	85	--	--	--	--
DINAH	26	50	20	87	16	91
FREDA	29	65	25	87	18	103
HARRIET	17	73	13	120	8	163
IVY	13	124	8	333	3	802
JEAN	24	66	20	178	16	255
LUCY	29	106	25	209	19	290
MARY	14	62	10	116	5	143
OLIVE	17	109	13	231	9	361
ROSE	15	45	11	108	3	239
SHIRLEY	16	139	12	395	3	676
TRIX	27	81	23	183	18	276
VIRGINIA	11	133	7	184	3	227
BESS	26	78	22	194	16	284
CARMEN	21	69	15	109	11	106
DELLA	23	70	17	147	11	340
FAYE	44	78	40	134	36	173

AVERAGE ERROR - 24 HR FORECASTS (405 CASES)... 82 MI  
 AVERAGE ERROR - 48 HR FORECASTS (314 CASES)... 172 MI  
 AVERAGE ERROR - 72 HR FORECASTS (208 CASES)... 236 MI

\*Includes Forecast Errors during tropical storm intensity

# FORECAST ERROR TABULATION - 1965

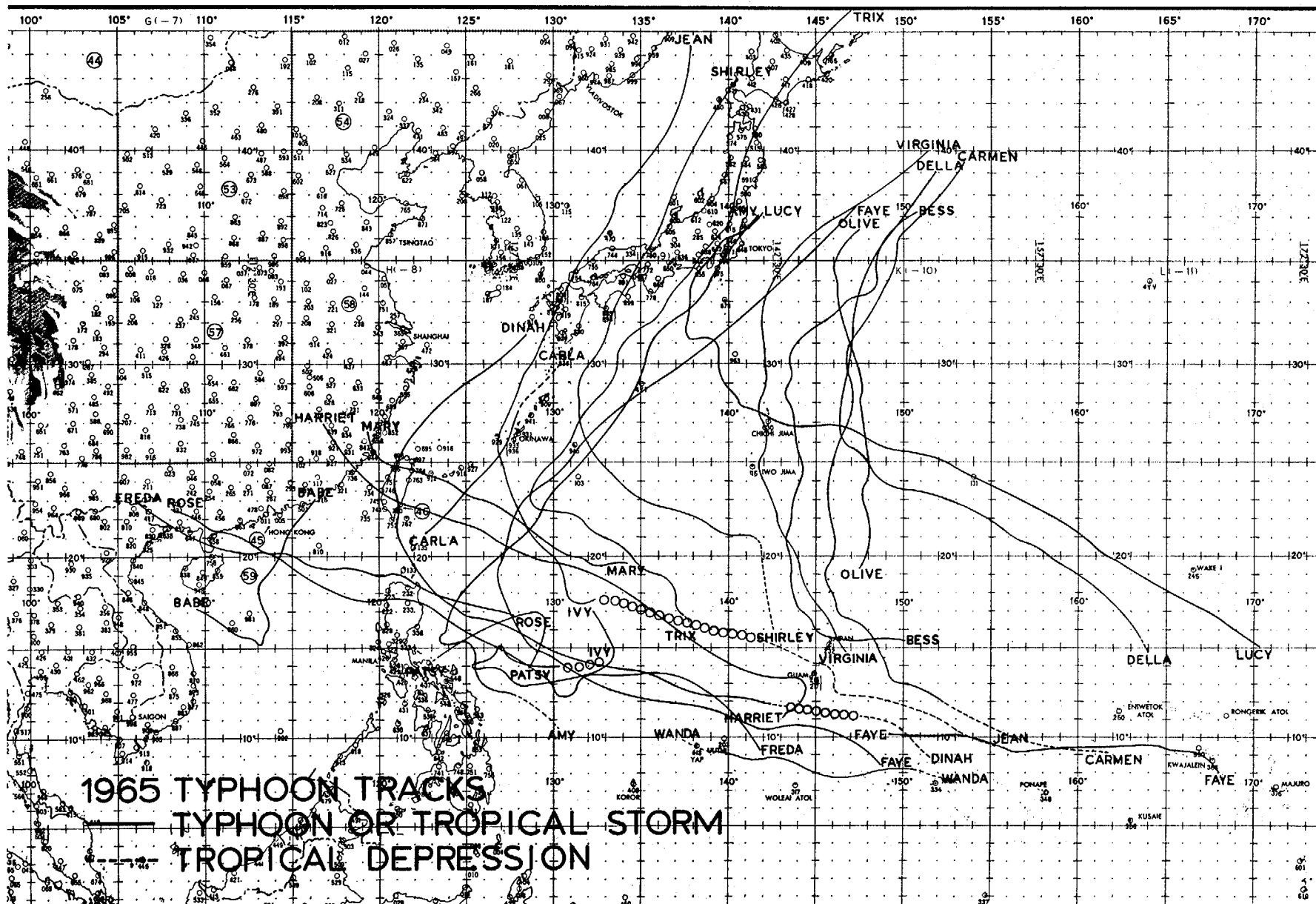
	NUMBER OF CASES	VECTOR		RIGHT ANGLE	
		MEAN	R.M.S.	MEAN	R.M.S.
<u>24 Hour</u>					
Total	405	151	182	82	103
Below 20N	177	134	161	75	96
20N-30N	160	140	162	80	98
Above 30N	67	222	263	106	130
Below 35N	375	142	170	78	100
Above 35N	30	272	295	130	142
<u>48 Hour</u>					
Total	314	303	358	172	211
Below 20N	111	261	314	149	189
20N-30N	137	281	333	173	214
Above 30N	66	411	469	206	239
Below 35N	285	287	340	171	212
Above 35N	29	459	499	179	204
<u>72 Hour</u>					
Total	208	418	494	267	294
Below 20N	60	333	397	190	254
20N-30N	94	402	463	241	294
Above 30N	54	542	627	279	333
Below 35N	184	386	451	269	295
Above 35N	24	670	760	255	284

DISTANCE BETWEEN OPERATIONAL WARNING  
POSITS AND BEST TRACK POSITS

CYCLONE	CASES	CYCLONE AVERAGE	MAX	MIN
1. PATSY	16	28	70	00
2. RUTH	18	77	252	00
3. SARAH	11	45	108	00
4. THELMA	5	65	104	09
5. VERA	3	30	39	22
6. WANDA	10	23	72	00
7. AMY	25	37	125	05
8. T. D.	4	82	125	42
9. BABE	20	22	77	05
10. CARLA	8	38	122	11
11. DINAH	34	15	48	00
12. EMMA	18	30	70	04
13. T. D.	7	65	90	40
14. FREDA	36	29	118	00
15. GILDA	23	45	144	05
16. HARRIET	25	35	125	03
17. JEAN	40	32	146	00
18. IVY	17	40	109	08
19. KIM	13	22	42	06
20. LUCY	33	20	99	00
21. MARY	18	26	146	00
22. NADINE	10	22	43	03
23. T. D.	10	70	215	12
24. T. D.	3	21	27	14
25. OLIVE	21	17	42	00
26. POLLY	12	47	120	00
27. ROSE	18	14	36	00
28. SHIRLEY	28	57	239	05
29. TRIX	33	30	123	04
30. T. D.	7	72	152	08
31. VIRGINIA	16	28	82	00
32. WENDY	39	50	194	00
33. AGNES	12	34	68	12
34. BESS	30	20	97	03
35. CARMEN	35	38	86	00
36. T. D.	7	24	42	00
37. DELLA	28	44	144	06
38. ELAINE	33	28	87	04
39. FAYE	49	33	163	00
40. GLORIA	12	69	206	03

OVERALL AVERAGE

34.7



# 1965 TROPICAL CYCLONES

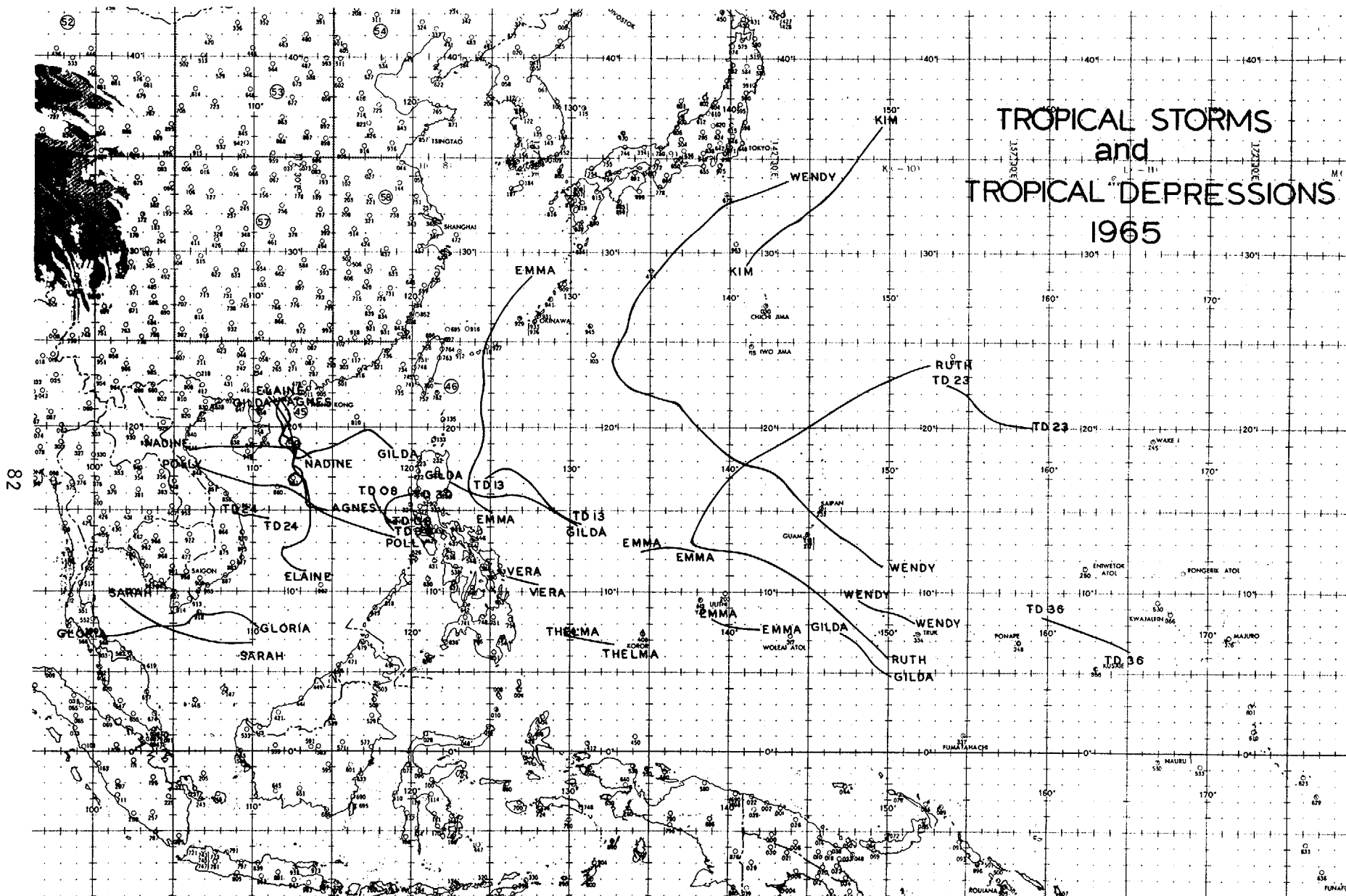
CYCLONE	TYPE	NAME	*DATE	*CALENDAR DAYS OF WARNING	*MAX SFC WINDS	MIN OBS SLP	MAX RADIUS SFC CIRC	TOTAL NO. WARNINGS ISSUED	NO. WARNINGS ISSUED AS TYPHOON	*DISTANCE TRAVELED
01	T	PATSY	19 JAN-23 JAN	5	65	989	375	17	6	619
02	TS	RUTH	21 JAN-25 JAN	5	60	996	490	18	-	2179
03	TS	SARAH	14 FEB-17 FEB	4	45	998	275	11	-	527
04	TS	THELMA	18 FEB-19 FEB	2	40	1001	200	5	-	208
05	TS	VERA	06 MAR-07 MAR	2	45	1003	300	4	-	122
06	T	WANDA	12 APR-14 APR	3	65	998	250	11	2	914
07	T	AMY	21 MAY-27 MAY	7	100	976	275	25	10	2250
08	TD		29 MAY-30 MAY	2	25	1000	250	4	-	90
09	T	BABE	30 MAY-04 JUN	6	80	985	275	21	12	576
10	T	CARLA	01 JUN-03 JUN	3	120	991	225	8	4	605
11	T	DINAH	10 JUN-19 JUN	10	160	932	525	37	24	2795
12	TS	EMMA	18 JUN-21 JUN	8	50	994	350	20	-	1308
			23 JUN-26 JUN							
13	TD		06 JUL-08 JUL	3	25	1003	300	8	-	305
14	T	FREDA	07 JUL-16 JUL	10	140	922	675	36	27	2400
15	TS	GILDA	13 JUL-14 JUL	6	60	986	550	25	-	1356
			17 JUL-23 JUL							
16	T	HARRIET	21 JUL-27 JUL	7	100	973	750	25	16	2080
17	T	JEAN	26 JUL-29 JUL	12	140	940	625	41	27	3565
			31 JUL-07 AUG							
18	T	IVY	27 JUL-31 JUL	6	80	991	325	18	12	1100
19	TS	KIM	04 AUG-07 AUG	4	60	980	175	13	-	620
20	T	LUCY	15 AUG-23 AUG	9	150	940	425	33	27	2583
21	T	MARY	15 AUG-19 AUG	5	150	936	600	18	14	1000
22	TS	NADINE	16 AUG-18 AUG	3	60	996	200	10	-	450
23	TD		26 AUG-28 AUG	3	25	1004	250	10	-	350
24	TD		26 AUG-26 AUG	1	25	1003	250	4	-	140
25	T	OLIVE	28 AUG-02 SEP	6	150	936	550	21	17	1118
26	TS	POLLY	30 AUG-02 SEP	4	45	992	425	12	-	804
27	T	ROSE	01 SEP-05 SEP	5	100	968	400	19	16	1232

1965 TROPICAL CYCLONES (Cont'd)

CYCLONE	TYPE	NAME	*DATE	*CALENDAR DAYS OF WARNING	*MAX SFC WINDS	MIN OBS SLP	MAX RADIUS SFC CIRC	TOTAL NO. WARNINGS ISSUED	NO. WARNINGS ISSUED AS TYPHOON	*DISTANCE TRAVELED
28	T	SHIRLEY	04 SEP-10 SEP	7	130	936	625	28	19	2255
29	T	TRIX	10 SEP-18 SEP	9	130	930	850	33	27	2497
30	TD		13 SEP-14 SEP	2	25	999	200	7	-	225
31	T	VIRGINIA	13 SEP-17 SEP	5	65	980	300	16	4	1858
32	TS	WENDY	16 SEP-25 SEP	10	50	986	400	39	-	2295
33	TS	AGNES	25 SEP-28 SEP	4	60	977	375	13	-	560
34	T	BESS	27 SEP-04 OCT	8	150	901	850	30	29	1775
35	T	CARMEN	01 OCT-09 OCT	10	150	916	825	37	18	2775
36	TD		08 OCT-09 OCT	2	25	996	275	16	-	358
37	T	DELLA	13 OCT-19 OCT	7	85	970	900	28	20	2100
38	TS	ELAINE	07 NOV-13 NOV	7	50	993	400	23	-	909
39	T	FAYE	14 NOV-25 NOV	13	135	925	700	49	21	4001
40	TS	GLORIA	18 DEC-21 DEC	4	40	1003	225	12	-	650
TOTALS				167				805	352	

\*DATA TAKEN FROM BEST TRACK

# TROPICAL STORMS and TROPICAL DEPRESSIONS 1965



TROPICAL STORMS 1965  
POSITION DATA

TROPICAL STORM RUTH  
21 JAN-25 JAN

DTG	LAT	LONG	DTG	LAT	LONG
210000Z	06.0N	150.0E	231200Z	15.4N	138.7E
210600Z	07.7N	148.2E	231800Z	16.6N	139.6E
211200Z	09.3N	146.3E	240000Z	17.8N	140.8E
211800Z	10.8N	144.3E	240600Z	18.7N	142.3E
220000Z	11.8N	142.3E	241200Z	19.6N	143.8E
220600Z	12.5N	140.6E	241800Z	20.7N	145.8E
221200Z	12.7N	139.3E	250000Z	22.3N	148.6E
221800Z	12.8N	138.3E	250600Z	23.8N	152.3E
230000Z	13.2N	137.6E	251200Z	24.6N	156.3E
230600Z	14.2N	137.9E			

TROPICAL STORM SARAH  
14 FEB-17 FEB

DTG	LAT	LONG	DTG	LAT	LONG
141800Z	06.8N	109.7E	160600Z	07.5N	105.1E
150000Z	06.8N	109.0E	161200Z	07.8N	104.3E
150600Z	06.8N	108.3E	161800Z	08.3N	103.4E
151200Z	06.8N	107.5E	170000Z	08.8N	102.7E
151800Z	07.1N	106.7E	170600Z	09.3N	102.1E
160000Z	07.3N	105.8E	171200Z	09.7N	101.6E

TROPICAL STORM THELMA  
18 FEB-19 FEB

DTG	LAT	LONG	DTG	LAT	LONG
180600Z	06.8N	132.8E	190000Z	07.3N	130.3E
181200Z	06.9N	131.9E	190600Z	07.5N	129.3E
181800Z	07.2N	131.2E			

TROPICAL STORM VERA  
06 MAR-07 MAR

DTG	LAT	LONG	DTG	LAT	LONG
060600Z	10.5N	128.0E	061800Z	10.8N	126.7E
061200Z	10.7N	127.3E	070000Z	11.0N	126.0E



TROPICAL STORM EMMA  
18 JUN-26 JUN

DTG	LAT	LONG	DTG	LAT	LONG
180600Z	07.7N	141.8E	231800Z	16.4N	123.5E
181200Z	07.8N	140.8E	240000Z	17.7N	123.8E
181800Z	08.0N	139.7E	240600Z	18.9N	124.4E
190000Z	08.5N	138.8E	241200Z	20.2N	124.4E
200600Z	12.5N	137.8E	241800Z	21.3N	124.2E
201200Z	12.8N	136.7E	250000Z	22.2N	124.4E
201800Z	12.7N	135.4E	250600Z	23.4N	124.4E
210000Z	12.6N	134.3E	251200Z	24.8N	124.7E
230600Z	14.9N	125.0E	251800Z	26.6N	125.5E
231200Z	15.4N	124.1E	260000Z	28.7N	127.4E

TROPICAL STORM GILDA  
13 JUL-14 JUL  
17 JUL-19 JUL  
20 JUL-23 JUL

DTG	LAT	LONG	DTG	LAT	LONG
130600Z	04.9N	150.1E	200600Z	19.7N	117.8E
131200Z	05.7N	149.0E	201200Z	19.6N	116.4E
131800Z	06.8N	148.1E	201800Z	18.9N	115.0E
140000Z	07.6N	146.9E	210000Z	18.6N	113.9E
171200Z	14.2N	130.4E	210600Z	18.4N	113.3E
171800Z	14.7N	129.4E	211200Z	18.2N	112.8E
180000Z	15.3N	128.3E	211800Z	18.6N	112.4E
180600Z	15.8N	127.2E	220000Z	19.0N	112.4E
181200Z	16.0N	126.1E	220600Z	19.5N	112.3E
181800Z	15.9N	124.9E	221200Z	20.0N	112.1E
190000Z	16.3N	123.6E	221800Z	20.7N	111.9E
190600Z	16.8N	122.3E	230000Z	21.3N	111.5E
200000Z	18.8N	118.8E	230600Z	21.7N	110.9E

TROPICAL STORM KIM  
04 AUG-07 AUG

DTG	LAT	LONG	DTG	LAT	LONG
041200Z	29.4N	141.0E	060600Z	32.8N	145.7E
041800Z	30.2N	141.6E	061200Z	33.6N	146.6E
050000Z	30.8N	142.3E	061800Z	34.4N	147.3E
050600Z	31.1N	142.9E	070000Z	35.2N	148.0E
051200Z	31.4N	143.6E	070600Z	35.9N	148.6E
051800Z	31.8N	144.2E	071200Z	36.7N	149.4E
060000Z	32.3N	144.8E			

# TROPICAL STORM NADINE

16 AUG-18 AUG

DTG	LAT	LONG	DTG	LAT	LONG
161200Z	18.2N	113.4E	171800Z	18.8N	110.5E
161800Z	18.5N	113.1E	180000Z	18.8N	109.3E
170000Z	18.7N	112.6E	180600Z	18.7N	108.2E
170600Z	18.6N	112.1E	181200Z	18.7N	106.9E
171200Z	18.7N	111.5E	181800Z	18.5N	105.6E

# TROPICAL STORM POLLY

30 AUG-02 SEP

DTG	LAT	LONG	DTG	LAT	LONG
301800Z	13.4N	118.7E	010600Z	16.2N	112.5E
310000Z	13.8N	117.5E	011200Z	16.6N	111.7E
310600Z	14.2N	116.3E	011800Z	16.5N	110.9E
311200Z	14.6N	115.2E	020000Z	16.8N	109.3E
311800Z	15.0N	114.2E	020600Z	17.3N	107.5E
010000Z	15.5N	113.4E	021200Z	17.8N	106.0E

# TROPICAL STORM WENDY

16 SEP-25 SEP

DTG	LAT	LONG	DTG	LAT	LONG
160600Z	08.1N	151.7E	210600Z	21.8N	135.1E
161200Z	08.6N	150.7E	211200Z	22.1N	134.0E
161800Z	08.9N	149.4E	211800Z	22.3N	133.5E
170000Z	09.6N	148.0E	220000Z	22.7N	133.1E
170600Z	11.7N	149.6E	220600Z	23.0N	132.8E
171200Z	12.2N	148.8E	221200Z	23.3N	132.7E
171800Z	12.7N	148.1E	221800Z	23.7N	132.5E
180000Z	13.2N	147.3E	230000Z	24.0N	132.5E
180600Z	13.7N	146.6E	230600Z	24.5N	132.7E
181200Z	14.3N	145.9E	231200Z	25.1N	133.0E
181800Z	14.9N	145.2E	231800Z	25.8N	133.4E
190000Z	15.4N	144.5E	240000Z	26.8N	133.6E
190600Z	16.3N	143.8E	240600Z	28.0N	134.4E
191200Z	17.0N	143.2E	241200Z	29.6N	135.9E
191800Z	17.6N	142.3E	241800Z	30.7N	137.0E
200000Z	17.7N	141.1E	250000Z	31.7N	138.3E
200600Z	18.4N	139.7E	250600Z	32.6N	139.4E
201200Z	19.4N	138.7E	251200Z	33.1N	141.2E
201800Z	20.4N	137.5E	251800Z	33.9N	143.4E
210000Z	21.6N	136.4E			

## TROPICAL STORM AGNES

25 SEP-28 SEP

DTG	LAT	LONG	DTG	LAT	LONG
250000Z	15.1N	114.8E	261800Z	19.0N	111.7E
250600Z	15.1N	114.4E	270000Z	19.8N	111.8E
251200Z	15.2N	113.6E	270600Z	20.8N	112.2E
251800Z	16.2N	113.2E	271200Z	21.4N	111.7E
260000Z	17.2N	112.8E	271800Z	21.9N	111.3E
260600Z	18.0N	112.3E	280000Z	22.3N	111.3E
261200Z	18.7N	112.3E			

## TROPICAL STORM ELAINE

07 NOV-13 NOV

DTG	LAT	LONG	DTG	LAT	LONG
071200Z	11.2N	113.1E	101200Z	16.9N	113.2E
071800Z	11.5N	112.5E	101800Z	17.4N	112.8E
080000Z	12.0N	112.1E	110000Z	17.9N	112.4E
080600Z	12.7N	111.9E	110600Z	18.4N	112.6E
081200Z	12.8N	112.4E	111200Z	18.8N	112.5E
081800Z	13.1N	112.9E	111800Z	19.1N	112.3E
090000Z	13.7N	113.5E	120000Z	19.3N	112.1E
090600Z	14.9N	113.7E	120600Z	19.5N	111.9E
091200Z	16.2N	113.6E	121200Z	20.3N	111.8E
091800Z	17.0N	113.1E	121800Z	20.9N	111.4E
100000Z	16.7N	112.4E	130000Z	21.5N	111.6E
100600Z	16.5N	112.8E			

## TROPICAL STORM GLORIA

18 DEC-21 DEC

DTG	LAT	LONG	DTG	LAT	LONG
180600Z	07.8N	110.2E	191800Z	07.7N	104.7E
181200Z	08.4N	109.4E	200000Z	07.5N	103.5E
181800Z	08.5N	108.3E	200600Z	07.2N	102.3E
190000Z	08.3N	107.3E	201200Z	07.1N	101.5E
190600Z	08.4N	106.3E	211800Z	07.1N	100.8E
191200Z	07.9N	105.9E	210000Z	07.2N	100.1E

TROPICAL DEPRESSIONS 1965  
POSITION DATA

TROPICAL DEPRESSION ZERO EIGHT  
29 MAY-30 MAY

DTG	LAT	LONG	DTG	LAT	LONG
291200Z	18.5N	114.5E	300000Z	18.0N	115.2E
291800Z	18.3N	114.7E	300600Z	17.8N	115.8E

TROPICAL DEPRESSION ONE THREE  
06 JULY-08 JULY

DTG	LAT	LONG	DTG	LAT	LONG
060600Z	14.5N	129.8E	070600Z	17.4N	126.5E
061200Z	15.3N	128.8E	071200Z	17.5N	125.8E
061800Z	16.3N	128.0E	071800Z	17.3N	125.3E
070000Z	17.0N	127.0E	080000Z	17.0N	124.6E

TROPICAL DEPRESSION TWO THREE  
26 AUGUST-28 AUGUST

DTG	LAT	LONG	DTG	LAT	LONG
260000Z	20.1N	158.8E	270600Z	21.3N	155.6E
260600Z	20.2N	158.1E	271200Z	21.8N	155.2E
261200Z	20.3N	157.3E	271800Z	22.2N	154.6E
261800Z	20.5N	156.6E	280000Z	22.4N	154.1E
270000Z	20.9N	156.0E	280600Z	22.5N	153.4E

TROPICAL DEPRESSION TWO FOUR  
26 AUGUST

DTG	LAT	LONG	DTG	LAT	LONG
260000Z	14.6N	110.9E	261200Z	14.7N	110.0E
260600Z	14.6N	110.5E	261800Z	14.9N	108.7E

TROPICAL DEPRESSION THREE ZERO  
13 SEPTEMBER-14 SEPTEMBER

DTG	LAT	LONG	DTG	LAT	LONG
130000Z	13.9N	118.9E	140000Z	15.7N	119.4E
130600Z	14.4N	118.4E	140600Z	15.9N	119.9E
131200Z	15.0N	118.4E	141200Z	15.9N	120.6E
131800Z	15.5N	118.7E			

TROPICAL DEPRESSIONS 1964  
POSITION DATA

TROPICAL DEPRESSION THREE SIX  
08 OCTOBER-09 OCTOBER

DTG	LAT	LONG	DTG	LAT	LONG
080600Z	06.4N	165.2E	090600Z	07.7N	161.5E
081200Z	06.8N	164.3E	091200Z	08.2N	160.7E
081800Z	07.1N	163.4E	091800Z	08.5N	159.7E
090000Z	07.4N	162.4E			

CHAPTER V

INDIVIDUAL TYPHOONS OF 1965

TYPHOON PATSY - 191200Z TO 231200Z JANUARY

I. DATA

A. Statistics

1. Number of warnings issued - 17
2. Number of warnings with typhoon intensity - 6
3. Total distance traveled during tropical warning period - 619 mi.

B. Characteristics as a typhoon

1. Minimum observed SLP - 989mbs at 200607Z and 200930Z
2. Minimum observed 700mb height - 3008m. at 200607Z
3. Maximum surface wind - 65 kts (From Best Track)
4. Maximum radius of surface circulation - 375 mi

II. DEVELOPMENT

A. Initial impetus - Fracture of short wave trough in westerlies and subsequent surge in northeast flow

B. Initial surface vortex

1. Embedded vortex at 160000Z
2. Surface pressure less than 1008mbs

C. 200mb flow above surface vortex

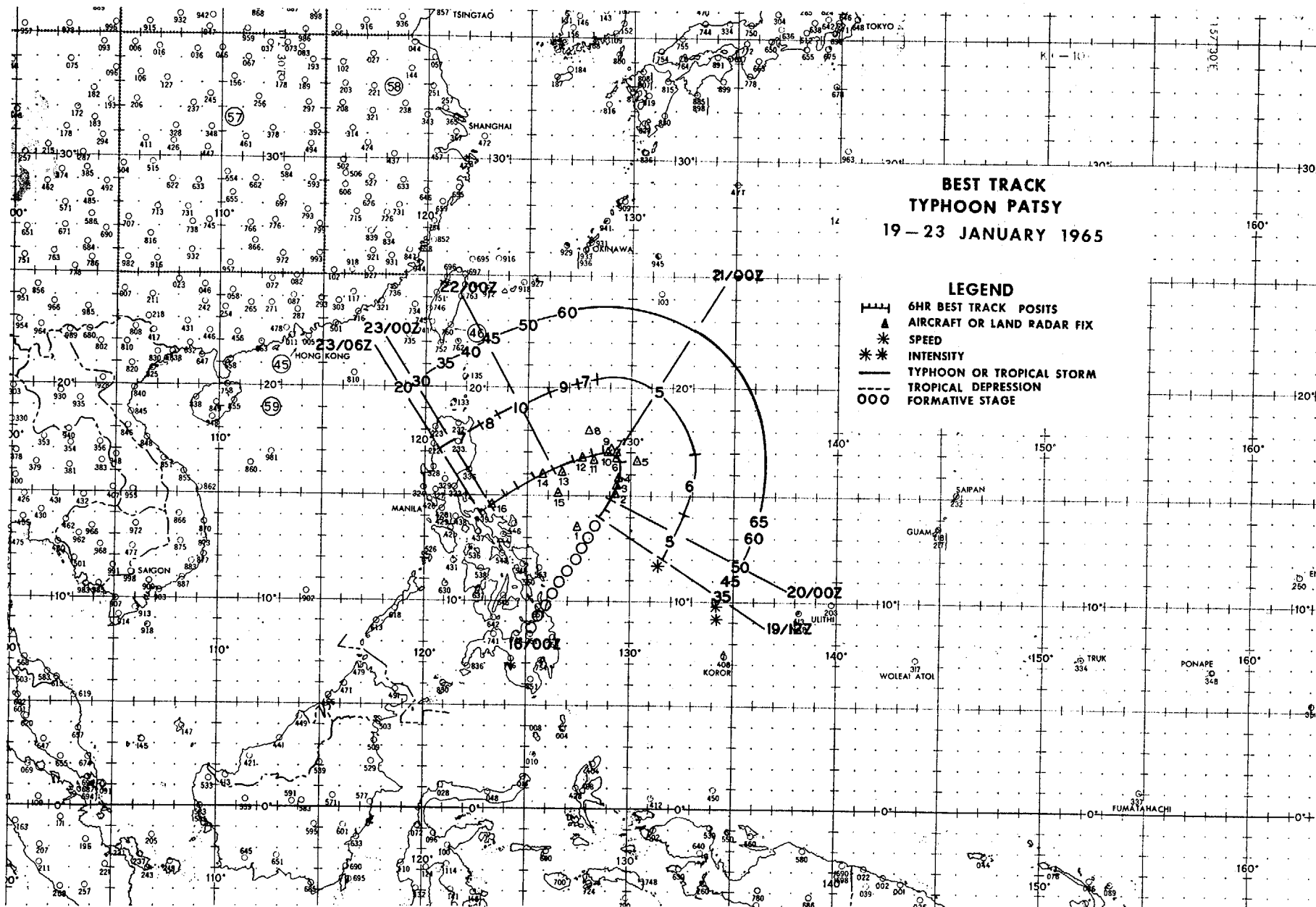
1. Initial-southeast
2. Upon reaching typhoon intensity - south

III. FINAL DISPOSITION

A. Dissipated over land

**BEST TRACK  
TYPHOON PATSY  
19-23 JANUARY 1965**

- LEGEND**
- 6HR BEST TRACK POSITS
  - ▲ AIRCRAFT OR LAND RADAR FIX
  - \* SPEED
  - \*\* INTENSITY
  - TYPHOON OR TROPICAL STORM
  - - - TROPICAL DEPRESSION
  - ooo FORMATIVE STAGE





## EYE FIXES TYPHOON PATSY

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	190408Z	13.5N 127.5E	TIROS	--	--	--	--	---	--/--	
2	200420Z	15.1N 129.3E	54-R-5	30000ft	30	50	---	---	--/--	AREA OF NO RDR RETURN 10 MI DIA, NO WALL CLD
3	200607Z	15.4N 129.3E	56-P-1	694mb	35	30	989	3008	12/12	NO WALL CLDS, SFC CALM 30 MI DIA
4	200930Z	15.8N 129.4E	VW1-P-5	1000ft	--	55	989	---	24/20	CIRC 30 MI DIA, NEG WALL CLD, OPN S
5	201530Z	16.5N 130.3E	VW1-R-15	10000ft	--	--	--	---	--/--	CNTR DIFFUSED, OPEN S
6	202203Z	16.8N 129.4E	54-V-5	30000ft	35	30	--	---	--/--	CIRC 20 MI DIA, WALL CLD 5 MI THICK OPEN S
7	202210Z	17.0N 129.4E	56-P-1	688mb	40	40	993	3030	15/12	EYE NOT DEFINED, ESTIMATED 40 MI DIA, NO RDR EYE
8	210314Z	18.0N 128.0E	TIROS	--	--	--	--	---	--/--	S & E PORTIONS ONLY VSBL
9	210345Z	17.1N 129.1E	56-P-1	682mb	45	65	991	3033	14/12	CIRC 40 MI DIA OPEN S, NO RDR EYE
10	210400Z	17.0N 129.0E	54-R-3	30000ft	20	30	--	---	--/--	OVAL 20 X 25 MI E-W
11	211030Z	16.7N 128.2E	VW1-P-5	1000ft	--	50	995	---	--/--	CIRC 30 MI DIA, NEG WALL CLD, OPEN SE QUAD
12	211545Z	16.8N 127.7E	VW1-P-10	10000ft	--	--	--	3085	14/07	CNTR 40 MI DIA
13	212219Z	16.1N 126.8E	56-P-10	700mb	30	40	1001	3100	15/15	NO ORGANIZED EYE, TEMP & WND CNTRS FIXED

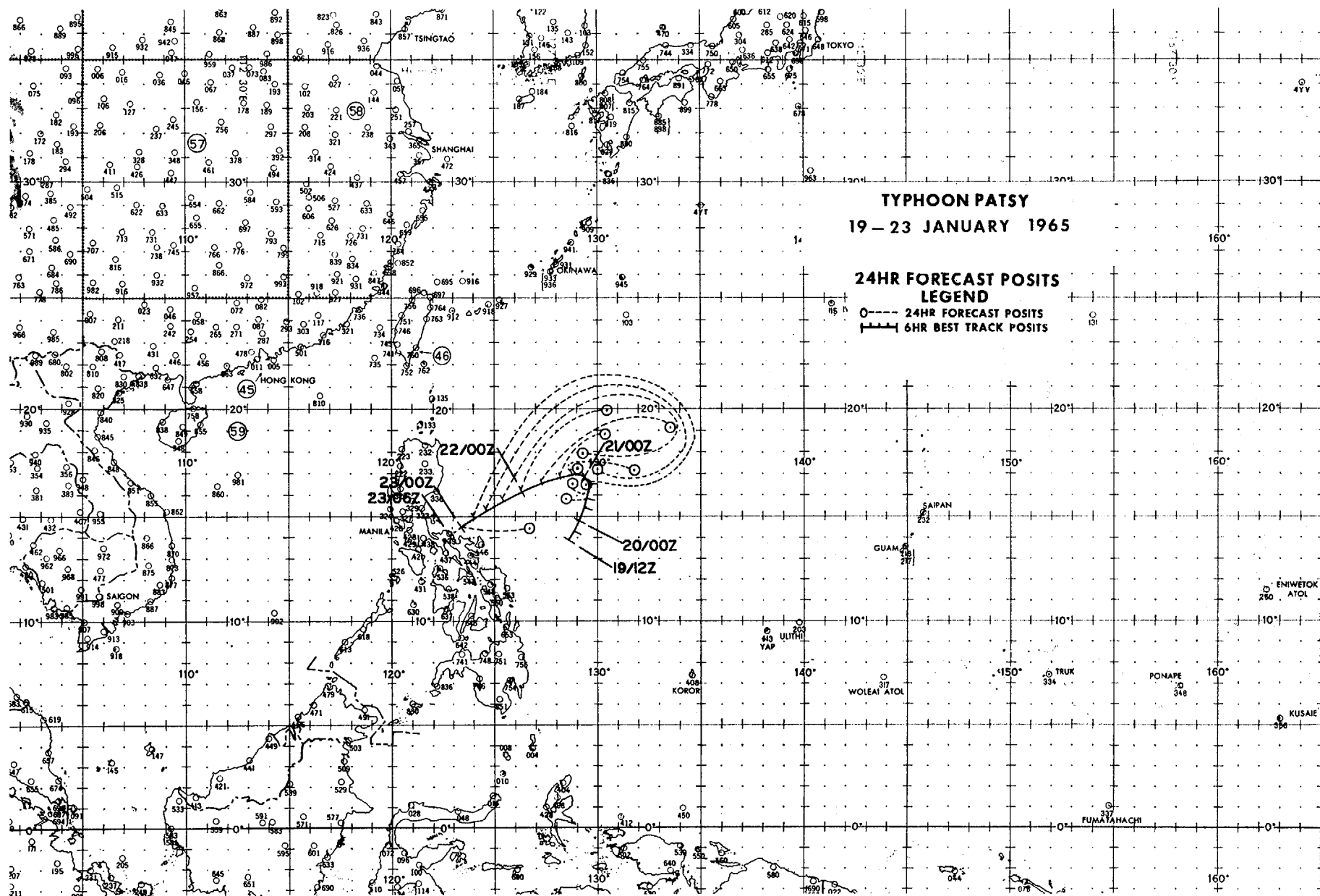
FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
14	220300Z	16.0N 125.8E	56-P-1	700mb	30	45	998	3088	16/14	EYE FILLED IN, NO WALL CLD, NO RADAR EYE
15	221030Z	15.1N 126.5E	VW1-P-15	10000ft	--	35	--	3117	11/05	NEG CLD FORMATION, PRES CNTR FIXED
16	230000Z	14.6N 123.4E	56-P-1	700mb	30	30	997	3094	14/06	CIRC, SFC CALM AREA 15 MI DIA, NO WALL CLD

TYPHOON PATSY 19 JAN-22 JAN 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
191200Z	14.0N	128.6E	-----	-----
191800Z	14.4N	128.8E	-----	-----
200000Z	14.8N	129.1E	-----	-----
200600Z	15.4N	129.2E	-----	-----
201200Z	15.9N	129.4E	270-64	-----
201800Z	16.5N	129.6E	283-45	-----
210000Z	16.9N	129.3E	020-23	-----
210600Z	17.0N	128.8E	085-172	-----
211200Z	16.8N	128.1E	045-172	042-155
211800Z	16.6N	127.3E	067-395	046-234
220000Z	16.2N	126.3E	046-335	046-450
220600Z	15.7N	125.3E	058-260	067-610
221200Z	15.3N	124.6E	070-330	053-684
221800Z	15.0N	124.0E	074-332	062-935

AVERAGE 24 HOUR ERROR 213 MI

AVERAGE 48 HOUR ERROR 511 MI



TYPHOON WANDA - 120000Z TO 141200Z APRIL

I. DATA

A. Statistics

1. Number of warnings issued - 10
2. Number of warnings with typhoon intensity - 2
3. Total distance traveled during tropical warning period - 914 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 998mbs at 120500Z
2. Minimum observed 700mb height - 3106m. at 122300Z
3. Maximum surface wind - 65 kts (From Best Track)
4. Maximum radius of surface circulation - 250 mi

II. DEVELOPMENT

A. Initial impetus - Southern hemispheric inflow at low and mid levels under mass divergence at 200 mbs

B. Initial surface vortex

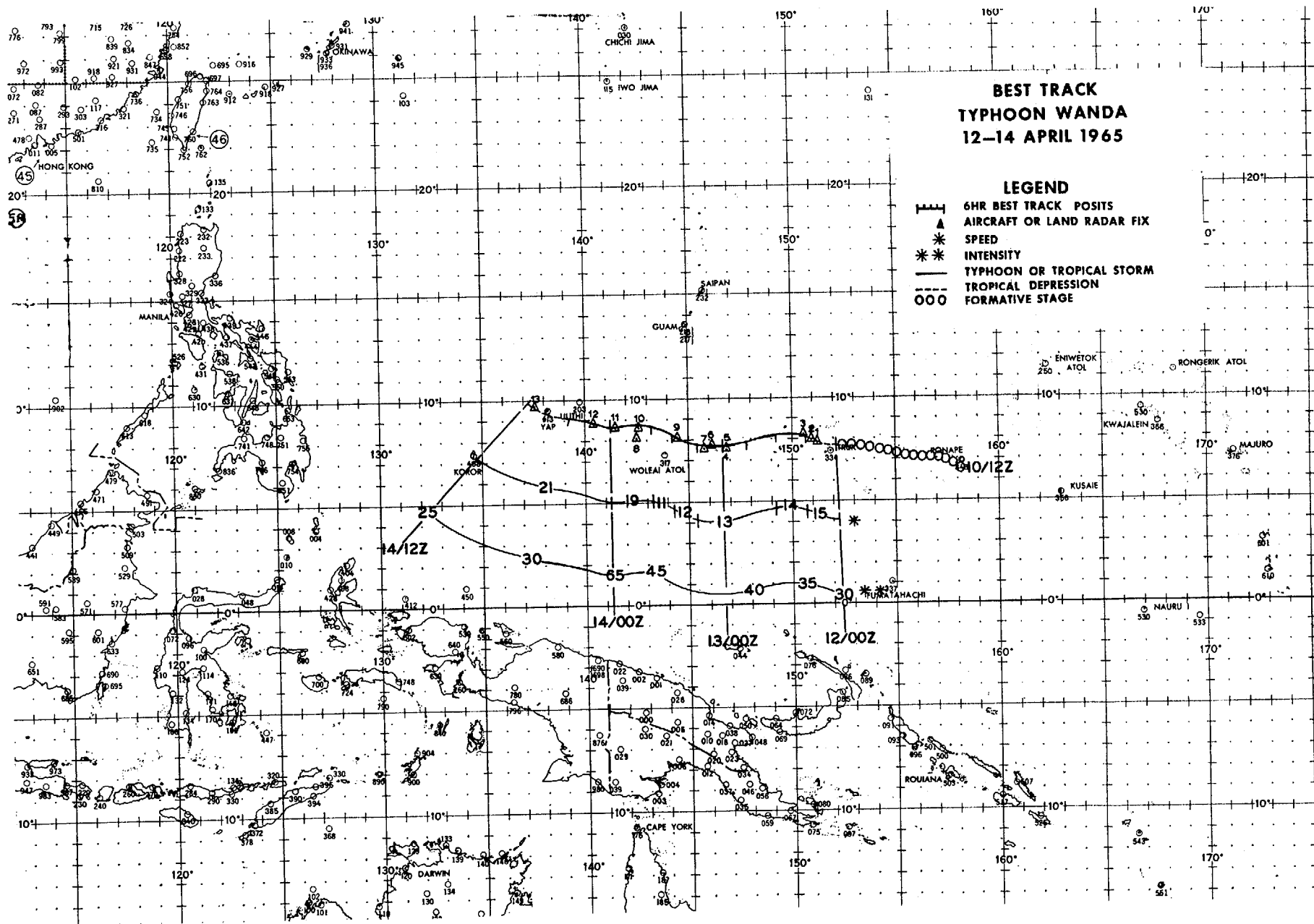
1. Junction vortex at 101200Z
2. Surface pressure less than 1010 mbs

C. 200mb flow above surface vortex

1. Initial - east
2. Upon reaching typhoon intensity - southeast

III. FINAL DISPOSITION

A. Moved under mid level anticyclonic flow



## EYE FIXES TYPHOON WANDA

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	120316Z	07.8N 151.3E	54-R-3	29700ft	40	25	--	----	--/--	POORLY DEFINED
2	120430Z	07.9N 151.1E	54-R-3	29600ft	45	--	--	----	--/--	CNTR NOT WELL ORGANIZED NO WALL CLD
3	120500Z	08.1N 150.6E	VW1-P-10	1500ft	--	35	998	----	--/--	CNTR NOT CLSD
4	122300Z	07.6N 146.9E	56-P-1	691mb	25	35	1003	3106	15/08	EYE ELLIP NE-SW CLSD SFC AND 700MB CNTRS
5	122339Z	07.7N 146.9E	54-P-5	30000ft	--	45	--	----	-32/--	NO WALL CLD
6	130332Z	07.8N 146.1E	54-R-0	30000ft	--	40	--	----	-32/--	TWO WEAK FDR BNDS FM NW & ONE HVY FDR BND FM W INTO EYE
7	130400Z	07.7N 145.8E	56-P-1	689mb	30	35	1003	----	--/--	SFC CIRC CLSD BUT 700MB CIRCN NOT CLSD
8	130952Z	08.1N 143.6E	VW1-P-10	1500ft	--	40	1000	----	23/22	CNTR DIFUS, OPEN N SEMI. HVY WX W FDR BNDS ALL QUADS
*9	131130Z	08.3N 144.4E	VW1-P-5	1500ft	--	--	1000	----	23/21	CNTR CLOSING NEWLY FORMED FDR BNDS E QUAD
10	131545Z	08.6N 143.7E	VW1-R-10	1500ft	--	--	--	----	--/--	CNTR DIFUS FDR BNDS WKNG
11	132300Z	08.6N 141.4E	56-P-2	694mb	35	65	--	3152	09/09	SFC CNTR OPEN S HALF
12	140300Z	08.8N 140.4E	56-P-2	694mb	25	50	1006	3133	11/07	AT 700MB S HALF OPEN CALM AT LEAST 100 MI S
13	141030Z	09.7N 137.7E	VW1-P-15	1200ft	35	--	1006	----	--/--	NEG WALL CLD MOD TO HVY BRKN ECHOES NW QUAD, OTHER QUADS OPEN

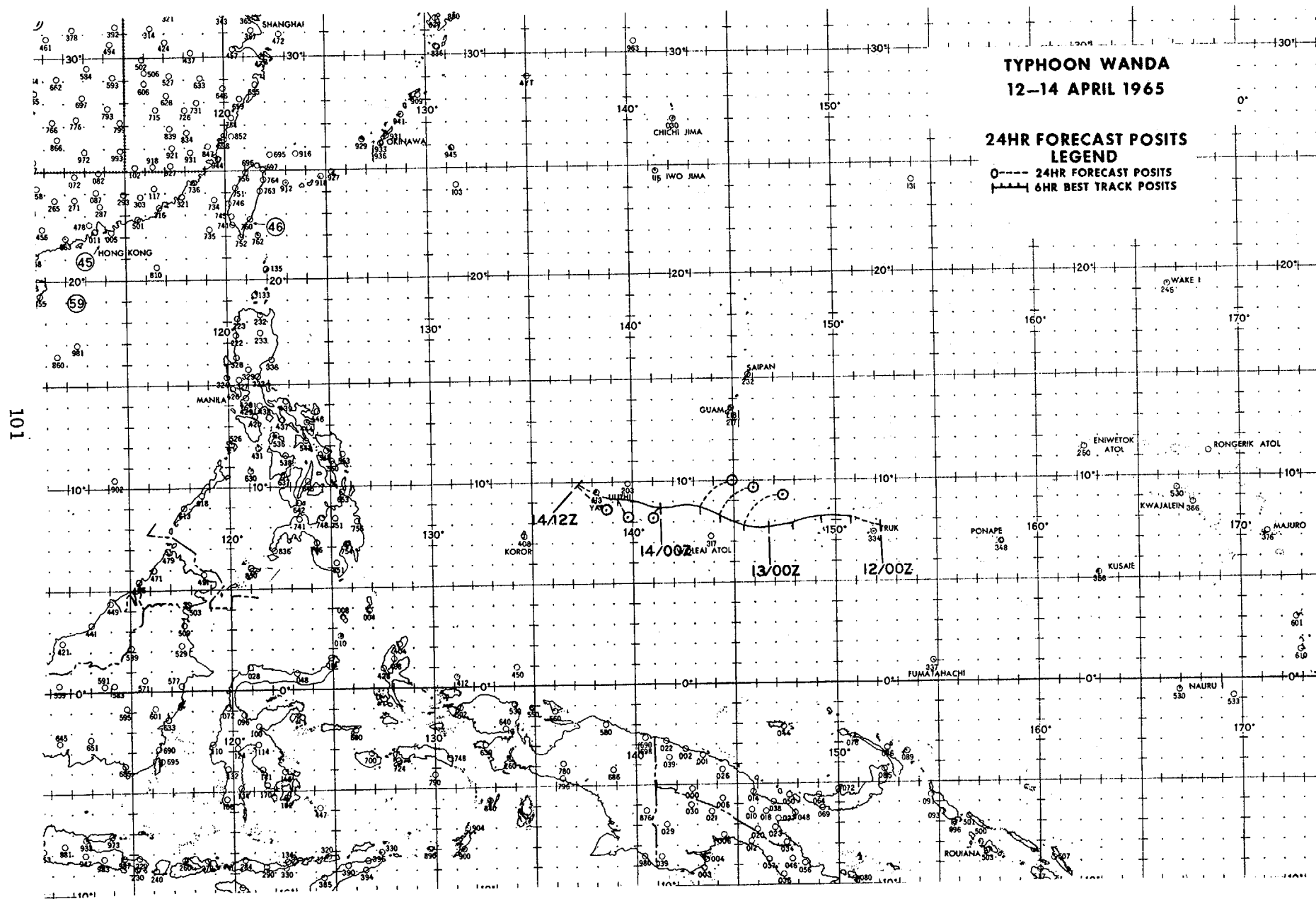
\*RELOCATED CENTER

TYPHOON WANDA 12 APR-14 APR 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
120000Z	07.6N	152.1E	-----	-----
120600Z	08.1N	150.6E	-----	-----
121200Z	08.2N	149.2E	-----	-----
121800Z	07.8N	147.9E	-----	-----
130000Z	07.7N	146.7E	-----	-----
130600Z	07.8N	145.4E	054-140	-----
131200Z	08.3N	144.3E	052-120	-----
131800Z	08.6N	143.3E	051-130	-----
140000Z	08.6N	141.3E	208-35	-----
140600Z	09.1N	139.3E	147-65	072-270
141200Z	09.8N	137.3E	135-105	078-290

AVERAGE 24 HOUR ERROR 99 MI  
AVERAGE 48 HOUR ERROR 280 MI





TYPHOON AMY - 210600Z TO 270600Z MAY

I. DATA

A. Statistics

1. Number of warnings issued - 25
2. Number of warnings with typhoon intensity - 10
3. Total distance traveled during tropical warning period - 2250 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 976mbs at 260900Z
2. Minimum observed 700mb height - 2923m. at 260900Z
3. Maximum surface wind - 100 kts (From Best Track)
4. Maximum radius of surface circulation - 275 mi

II. DEVELOPMENT

A. Initial impetus - Southern hemispheric inflow at low and mid levels

B. Initial surface vortex

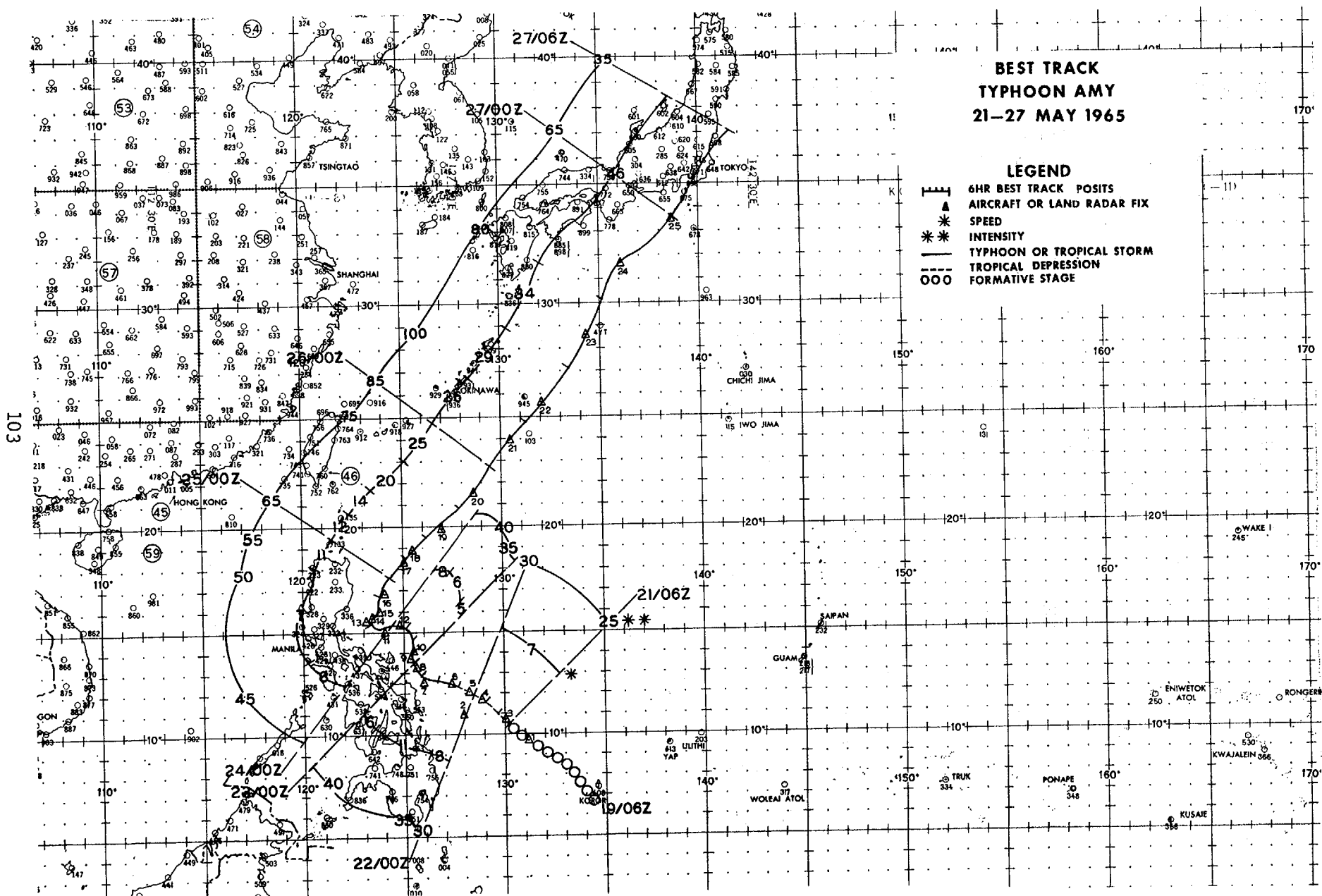
1. Junction vortex at 190600Z
2. Surface pressure less than 1006mbs

C. 200mb flow above surface vortex

1. Initial - southwestern
2. Upon reaching typhoon intensity - center of anticyclone

III. FINAL DISPOSITION

A. Became extratropical



## EYE FIXES TYPHOON AMY

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	210135Z	09.6N 131.2E	54-R-5	30000ft	30	30	--	---	-30/--	
2	210216Z	11.0N 128.0E	TIROS	--	--	--	--	---	--/--	STAGE D, DIA 4, BNDS 1 OVC AREA 4 DEG DIA
3	210715Z	10.6N 130.1E	VW1-P-10	600ft	--	25	996	---	27/20	CNTR POORLY DEFINED 50 MI DIA OPEN NW & SE NO WALL CLD
4	212100Z	11.7N 128.9E	VW1-P-6	1500ft	--	25	995	---	24/19	CNTR CIRC 25 MI DIA PRES, WND, RADAR CNTRS CORRESPOND
5	220330Z	12.0N 128.3E	56-P-5	700mb	--	30	--	---	--/--	CLSD CIRC AT SFC ONLY NO CLSD CIRC AT 700MB
6	220800Z	12.4N 127.6E	56-P-4	700mb	20	35	1001	3045	11/03	CLSD CIRC AT SFC & 700MB WALL CLD TOPS 11000 FT
7	221440Z	12.5N 126.0E	VW1-R-U	700mb	--	--	--	---	14/08	BRKN WALLED CNTR ON RDR
8	222130Z	13.2N 125.7E	VW1-P-10	1000ft	--	25	998	---	26/22	ELIP 15X 5 MI NE-SW NEG BNDG RAPID DSPTN ALL QUADS
9	230329Z	13.7N 125.3E	56-P-2	692mb	20	25	995	3051	13/10	NO RDR EYE 700MB OPEN S, SFC CIRC CLSD
10	230800Z	14.0N 125.4E	56-P-2	692mb	30	30	993	3039	14/09	NO RDR EYE SFC CALM 30 MI DIA
11	231445Z	15.0N 124.1E	VW1-R-10	700mb	--	--	--	---	--/--	CNTR ELIP 40 X 20 MI N-S MAX TOPS OVER 35000FT

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
12	232130Z	15.2N 124.8E	VW1-P-5	800ft	--	40	993	----	28/19	CNTR CIRC 30 MI DIA
13	240345Z	15.4N 123.2E	56-E-U	3260M	--	--	--	----	--/--	APPROX CNTR UNABLE TO MAKE FIX DUE NUMEROUS FUNNEL CLDS
14	240840Z	15.8N 123.5E	56-R-5	3250M	45	45	--	----	--/--	EYE CIRC 10 MI DIA STG SPIRAL BNDS W & N QUADS
15	241521Z	16.0N 123.9E	VW1-R-10	3500ft	--	--	--	----	--/--	EYE CIRC 9 MI DIA PATTERN SUGGESTS WND IN EXCESS OF 65 KTS AT 3500 FT
16	242100Z	16.9N 124.1E	VW1-P-5	700ft	--	65	979	----	24/15	RDR CNTR 230 DEG 5 MI FM WIND CNTR. CNTR OPEN NW QUAD
105 17	250450Z	18.3N 125.1E	56-P-3	700mb	60	55	982	2951	11/10	EYE CIRC 25 MI DIA
18	250900Z	18.9N 125.6E	56-P-2	700mb	65	65	982	2947	16/11	EYE CIRC 15 MI DIA LGT RAIN IN EYE
19	251500Z	19.9N 127.0E	VW1-R-10	7000ft	--	--	--	----	--/--	INTENSE EYE CIRC 20 MI DIA
20	252100Z	21.5N 128.7E	VW1-R-10	8000ft	--	--	--	----	--/--	EYE CIRC 17 MI DIA
21	260400Z	24.0N 130.5E	56-P-1	700mb	70	100	979	2944	12/10	RDR & 700MB CNTRS 10 MI E OF SFC CNTR
22	260900Z	25.7N 132.1E	56-P-1	700mb	70	100	976	2923	16/09	EYE CIRC 20 MI DIA
23	261515Z	28.6N 134.3E	VW1-R-20	7000ft	--	--	--	----	--/--	NEG RDR EYE ALL ECHOES VERY WK AND DSPTG
24	262050Z	31.6N 136.1E	VW1-P-10	1300ft	--	65	982	----	23/15	NEG WALL CLD MOST CLDS STRATIFIED
25	270000Z	33.5N 138.7E	LND RDR	--	--	--	--	----	--/--	JAPANESE LND RDR REPORT

TYPHOON AMY 21 MAY-27 MAY 1965  
POSITION AND FORECAST VERIFICATION DATA

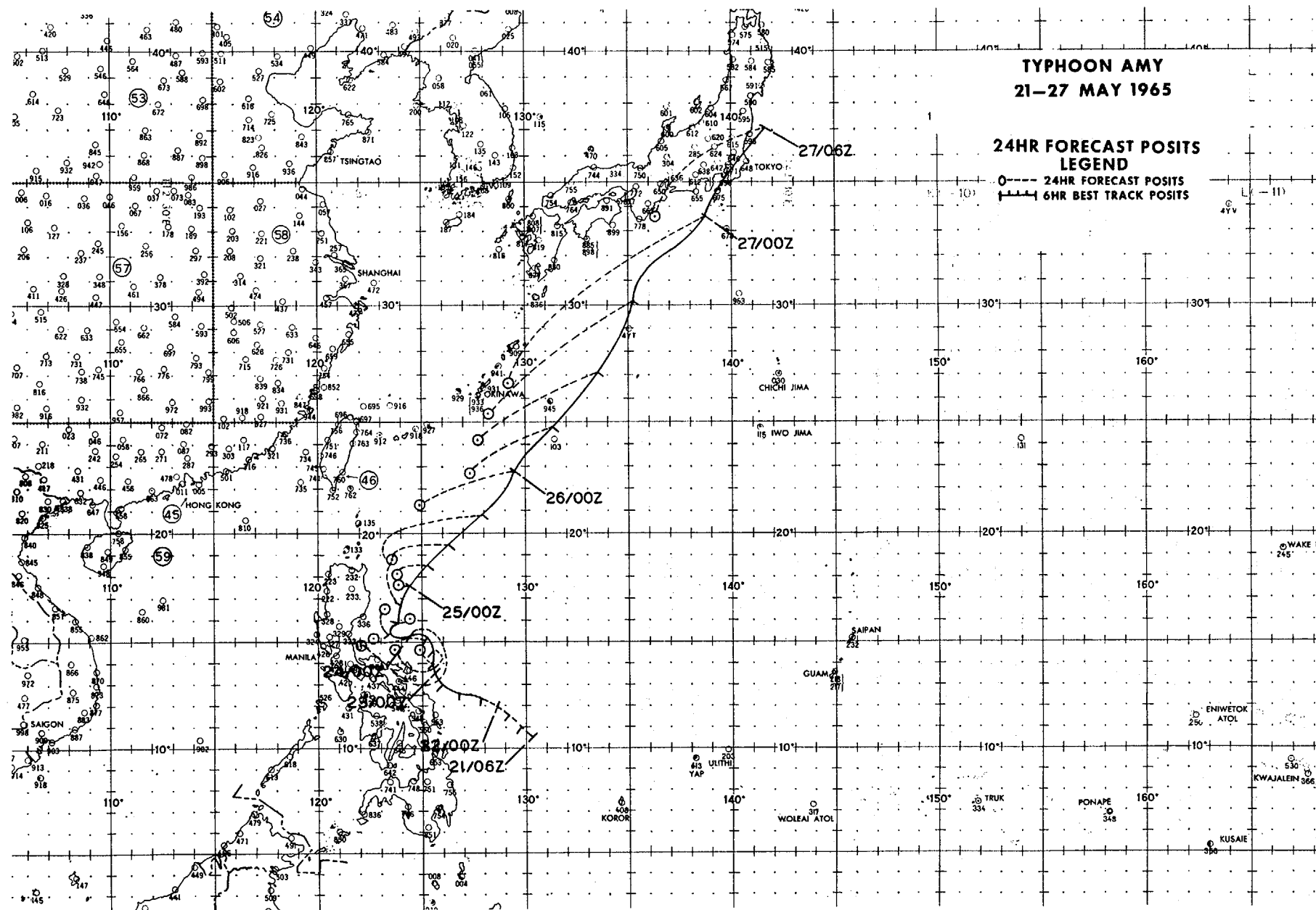
DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
210600Z	10.5N	130.3E	-----	-----
211200Z	11.0N	129.8E	-----	-----
211800Z	11.5N	129.2E	-----	-----
220000Z	11.9N	128.6E	-----	-----
220600Z	12.3N	127.9E	-----	-----
221200Z	12.5N	126.8E	-----	-----
221800Z	12.9N	125.8E	-----	-----
230000Z	13.5N	125.5E	-----	-----
230600Z	13.9N	125.4E	329-50	-----
231200Z	14.5N	125.4E	276-103	-----
231800Z	15.1N	125.1E	272-138	-----
240000Z	15.2N	124.3E	264-130	-----
240600Z	15.3N	123.4E	350-77	286-164
241200Z	15.9N	123.8E	077-45	271-252
241800Z	16.6N	123.9E	349-125	265-328
250000Z	17.6N	124.5E	279-33	272-270
250600Z	18.5N	125.2E	254-82	292-177
251200Z	19.5N	126.3E	258-154	234-150
251800Z	20.8N	127.9E	247-266	285-262
260000Z	22.8N	129.6E	252-273	252-370
260600Z	24.8N	131.3E	240-258	245-491
261200Z	27.2N	133.4E	240-350	243-587
261800Z	30.2N	135.1E	232-467	233-738
270000Z	33.5N	138.7E	231-653	233-750
270600Z	37.3N	141.8E	230-362	228-875

AVERAGE 24 HOUR ERROR 210 MI  
AVERAGE 48 HOUR ERROR 417 MI

**TYPHOON AMY**  
**21-27 MAY 1965**

**24HR FORECAST POSITS**  
**LEGEND**

○---○ 24HR FORECAST POSITS  
--- 6HR BEST TRACK POSITS



TYPHOON BABE - 301800Z MAY TO 041800Z JUNE

I. DATA

A. Statistics

1. Number of warnings issued - 21
2. Number of warnings with typhoon intensity - 12
3. Total distance traveled during tropical warning period - 576 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 985mbs at 022045Z
2. Minimum observed 700mb height - 3011m. at 020900Z
3. Maximum surface wind - 80 kts (From Best Track)
4. Maximum radius of surface circulation - 275 mi

II. DEVELOPMENT

A. Initial impetus - Formed in shear between mid level westerly flow to south and northeasterly to north under leading edge of intensifying anti-cyclone at 200mb

B. Initial surface vortex

1. Junction vortex at 300000Z
2. Surface pressure less than 1004mbs

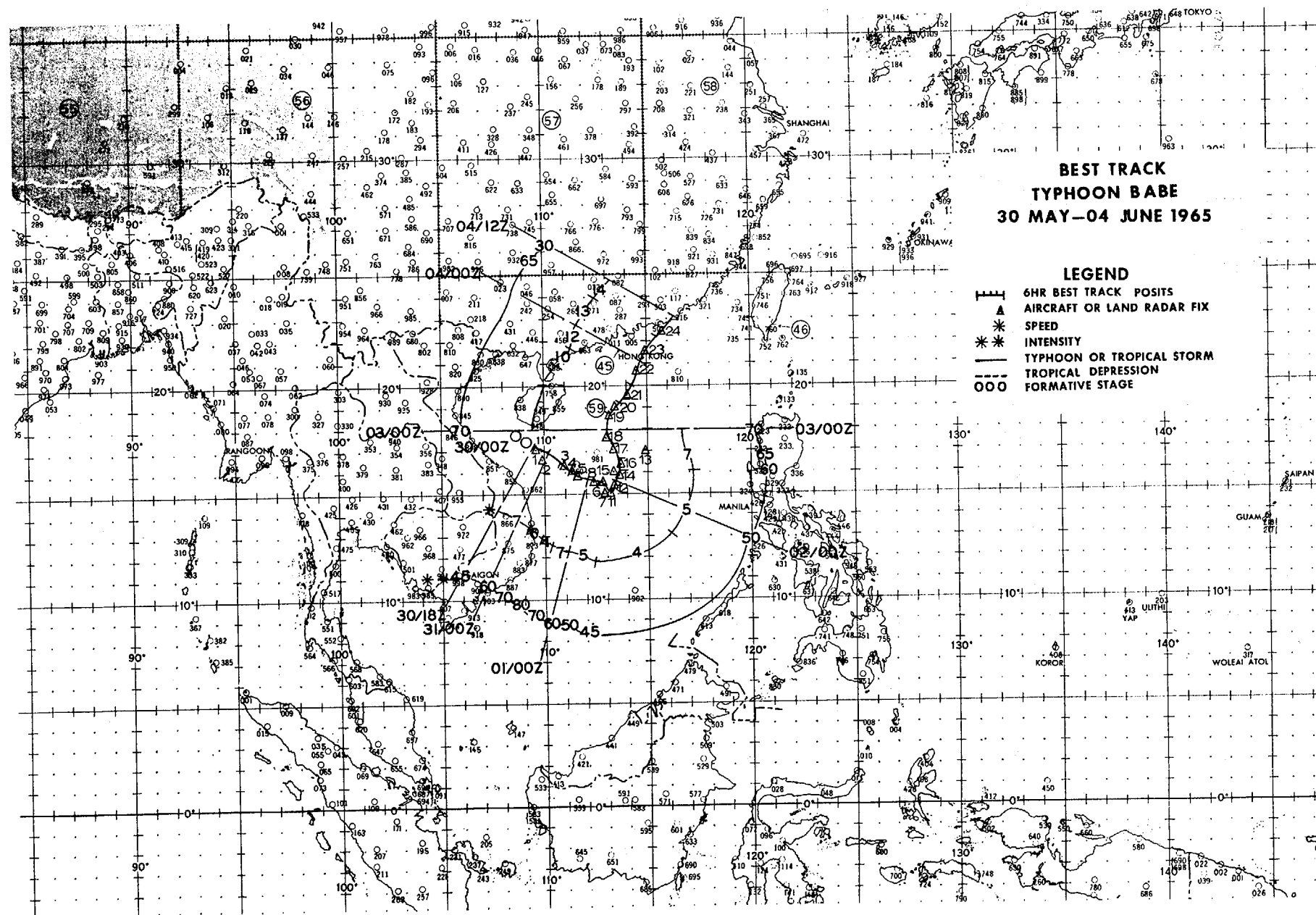
C. 200mb flow above surface vortex

1. Initial - northwest
2. Upon reaching typhoon intensity - northeast

III. FINAL DISPOSITION

A. Dissipated over land





## EYE FIXES TYPHOON BABE

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	301830Z	17.1N 109.7E	VW1-E-U	2200ft	--	--	--	---	--/--	REPORTED AS POSSIBLE CNTR
2	302330Z	16.6N 110.0E	VW1-E-U	1500ft	--	60	--	---	--/--	
3	310845Z	16.3N 111.1E	VW1-P-P5	1200ft	--	80	991	---	29/24	
4	311445Z	16.1N 111.4E	VW1-P-P5	2000ft	--	--	998	---	24/19	EYE ELIP 18 X 8 WSW-ENE
5	312200Z	15.8N 111.7E	VW1-P-3	1500ft	--	--	--	---	--/--	
6	010324Z	15.4N 112.9E	54-R-5	35000ft	--	--	--	---	--/--	EYE CIRC 20 MI DIA
7	010411Z	15.0N 113.0E	TIROS	--	--	--	--	---	--/--	BABE ON EDGE OF PICTURES
8	010540Z	15.4N 112.6E	56-P-2	695mb	25	50	1000	3112	11/09	EYE CIRC 40 MI DIA DEF CLSD SFC CIRC, SEVERAL CLSD CNTRS AT 700MB
9	010800Z	15.3N 112.5E	USS MID- WAY RDR	--	--	--	--	---	--/--	EYE 20 MI DIA
10	010845Z	15.4N 113.0E	56-P-2	691mb	40	45	1000	3097	10/09	EYE CIRC 40 MI DIA NO SFC OR 700MB CALM; GOOD CIRC
11	011440Z	15.0N 113.2E	VW1-P-F5	1300ft	--	--	1004	---	25/17	CNTR ILL DEFINED NO WALL CLDS
12	012150Z	15.4N 113.5E	VW1-P-5	1000ft	--	45	996	---	--/--	EYE ELIP 40 X 32 NE-SW, OPEN NE
13	020323Z	17.0N 115.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 4.5, BNDS 2
14	020400Z	15.8N 113.7E	56-R-3	700mb	--	--	--	---	--/--	EYE CIRC 10 MI DIA

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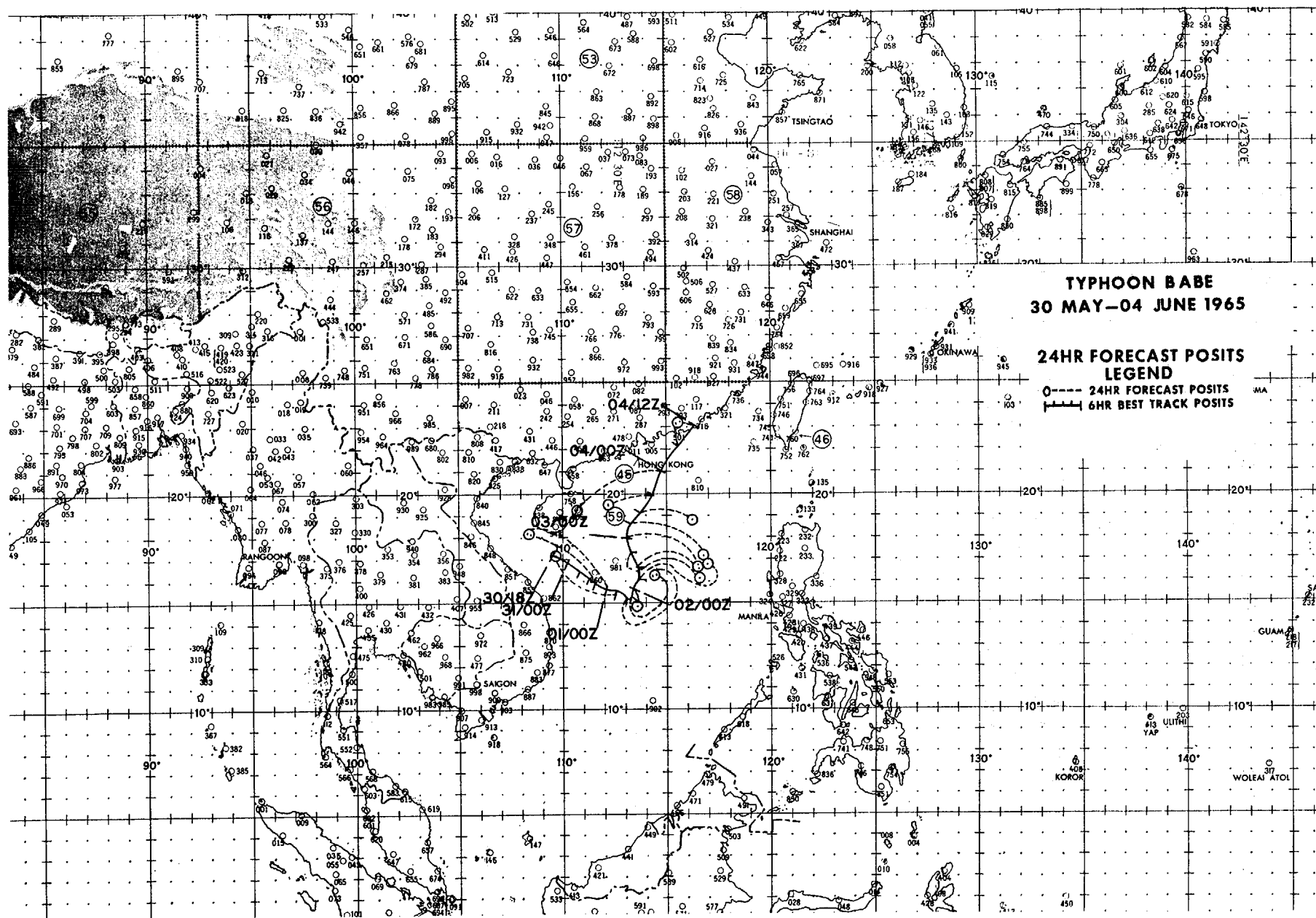
FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
15	020550Z	16.0N 113.5E	56-P-2	686mb	60	45	--	3075	--/--	700MB CNTR REPORTED
16	020900Z	16.3N 113.8E	56-P-2	686mb	45	65	989	3011	11/09	GOOD CIRC IN LOW CU
17	021532Z	17.0N 113.4E	VW1-P-P3	1350ft	--	--	995	---	23/19	EYE CIRC 24 MI DIA, OPEN N AND NE
18	022045Z	17.5N 113.1E	VW1-P-P3	1250ft	--	--	985	---	24/19	EYE CIRC 22 MI DIA
19	030400Z	18.6N 113.2E	56-P-10	690mb	60	70	990	3012	17/12	EYE CIRC 15 MI DIA, OPEN E AND S
20	030900Z	19.0N 113.5E	56-P-2	690mb	45	65	992	3045	15/12	EYE CIRC 15 MI DIA, TOPS 8000 FT SYSTEM APPEARS TO BE DSPTG
21	031515Z	19.5N 114.1E	VW1-P-5	1500ft	--	--	997	---	26/16	CNTR ILL DEFINED
22	032055Z	20.6N 114.7E	VW1-R-5	1500ft	--	--	--	---	--/--	CNTR POORLY DEFINED
23	040245Z	21.6N 115.0E	56-P-3	694mb	45	45	1005	3094	09/09	EYE CIRC, MULTIPLE CNTRS AT 700MB
24	040730Z	22.4N 115.8E	56-E-U	10400ft	--	65	--	---	--/--	EST POSIT FROM SFC WINDS

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TYPHOON BABE 30 MAY-04 JUNE 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
301800Z	17.3N	109.6E	-----	-----
310000Z	16.9N	110.2E	-----	-----
310600Z	16.5N	110.8E	-----	-----
311200Z	16.2N	111.3E	-----	-----
311800Z	15.9N	111.6E	307-227	-----
010000Z	15.5N	112.2E	303-286	-----
010600Z	15.4N	112.7E	303-202	-----
011200Z	15.2N	113.1E	050-95	-----
011800Z	15.2N	113.4E	051-091	304-436
020000Z	15.6N	113.7E	178-44	300-460
020600Z	16.1N	113.8E	077-189	287-348
021200Z	16.7N	113.6E	093-180	078-330
021800Z	17.3N	113.2E	109-221	084-325
030000Z	18.0N	113.1E	109-225	105-238
030600Z	18.6N	113.3E	114-225	074-407
031200Z	19.2N	113.8E	098-150	081-354
031800Z	20.0N	114.4E	257-127	092-300
040000Z	21.1N	114.8E	245-257	107-324
040600Z	22.2N	115.6E	355-65	119-317
041200Z	23.2N	116.4E	277-43	117-235

AVERAGE 24 HOUR ERROR 164 MI  
AVERAGE 48 HOUR ERROR 340 MI



TYPHOON CARLA - 011200Z TO 030600Z JUNE

I. DATA

A. Statistics

1. Number of warnings issued - 8
2. Number of warnings with typhoon intensity - 4
3. Total distance traveled during tropical warning period - 605 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 991 mbs at 012115Z
2. Minimum observed 700mb height - 3057m. at 010945Z
3. Maximum surface wind - 120 kts (From Best Track)
4. Maximum radius of surface circulation - 225 mi

II. DEVELOPMENT

A. Initial impetus - surge in southerly mid level inflow

B. Initial surface vortex

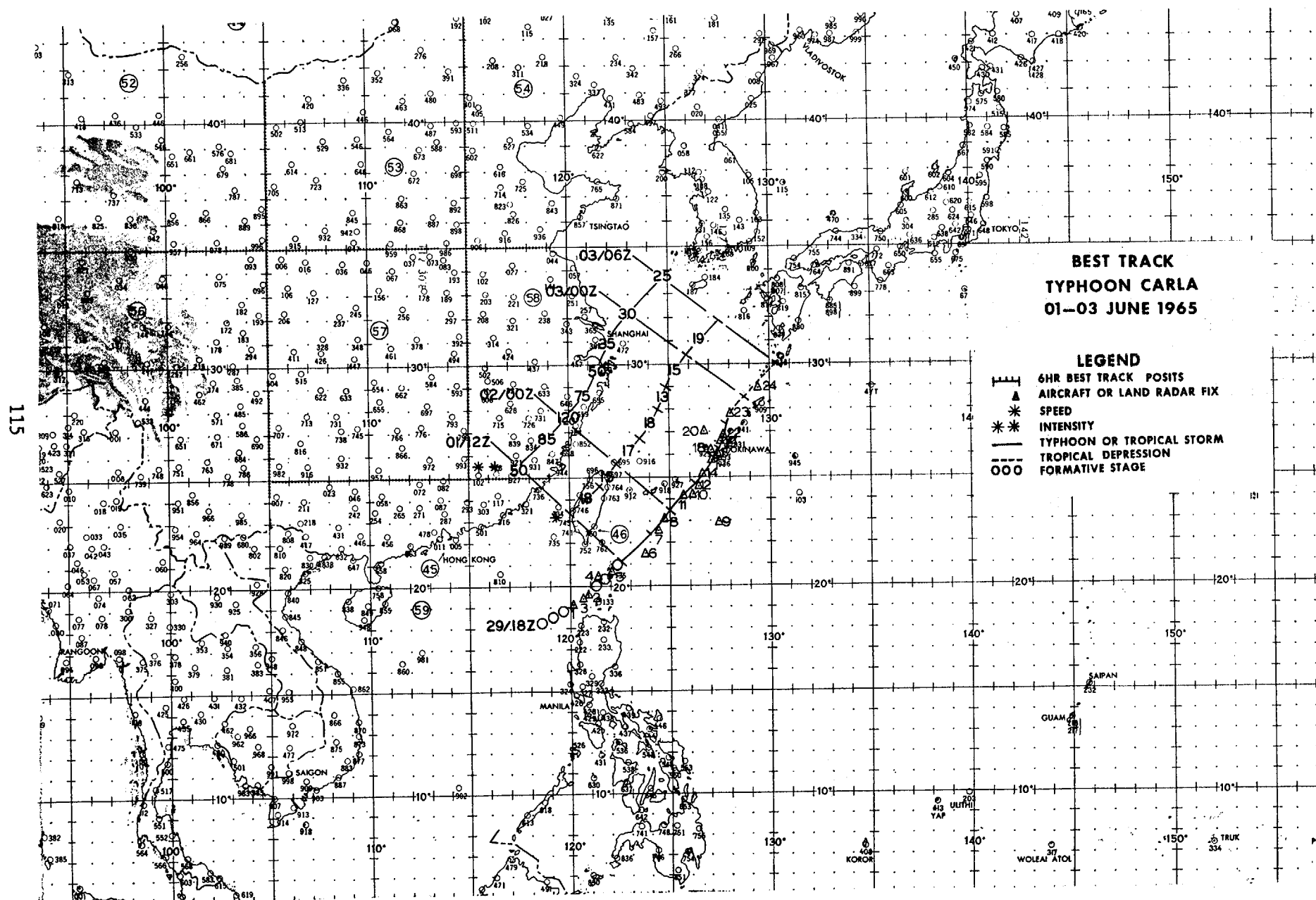
1. Junction vortex at 291800Z
2. Surface pressure less than 1004 mbs

C. 200mb flow above surface vortex

1. Initial - northwest
2. Upon reaching typhoon intensity - northwest

III. FINAL DISPOSITION

A. Became extratropical



## EYE FIXES TYPHOON CARLA

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	312300Z	19.1N 120.2E	LND RDR	--	--	--	--	---	--/--	LAOAG RADAR REPORT
2	010230Z	19.7N 121.0E	ACFT RPT	25000ft	--	--	--	---	--/--	NAVY P3A REPORTED 35 MI DIA EYE
3	010330Z	19.5N 120.8E	LND RDR	--	--	--	--	---	--/--	LAOAG RDR REPORT
4	010645Z	20.5N 121.5E	LND RDR	--	--	--	--	---	--/--	LAOAG RDR REPORT
5	010945Z	20.7N 122.1E	56-P-1	696mb	45	50	997	3057	16/10	EYE CIRC 15 MI DIA RDR & 700MB CNTR BEARS 122 DEG 9 MI
6	011450Z	21.5N 123.9E	ACFT RPT	33000ft	--	--	--	---	--/--	CIRC RDR EYE
7	012030Z	22.7N 124.6E	LND RDR	--	--	--	--	---	--/--	EYE HAS CLSD CONSIDERABLY, 4 TO 6 MI DIA
8	012115Z	23.1N 124.8E	VW1-R-3	1500ft	--	120	991	---	23/20	EYE CIRC 10 MI DIA SOLID WALL CLD TOPS EXCEED 35000 FT
9	020225Z	23.0N 127.5E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 4, BNDS 3 NO EYE VSBL
10	020300Z	24.3N 126.3E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
11	020350Z	24.2N 125.7E	56-P-2	691mb	60	65	995	3079	16/10	SFC CNTR VERY WK. RDR EYE BEARS 070 DEG 30 MI
12	020400Z	24.6N 126.5E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
13	020430Z	24.6N 126.6E	LND RDR	--	--	--	--	---	--/--	KADENA RDR POSSIBLE EYE 18 MI DIA TOPS TO 46000 FT

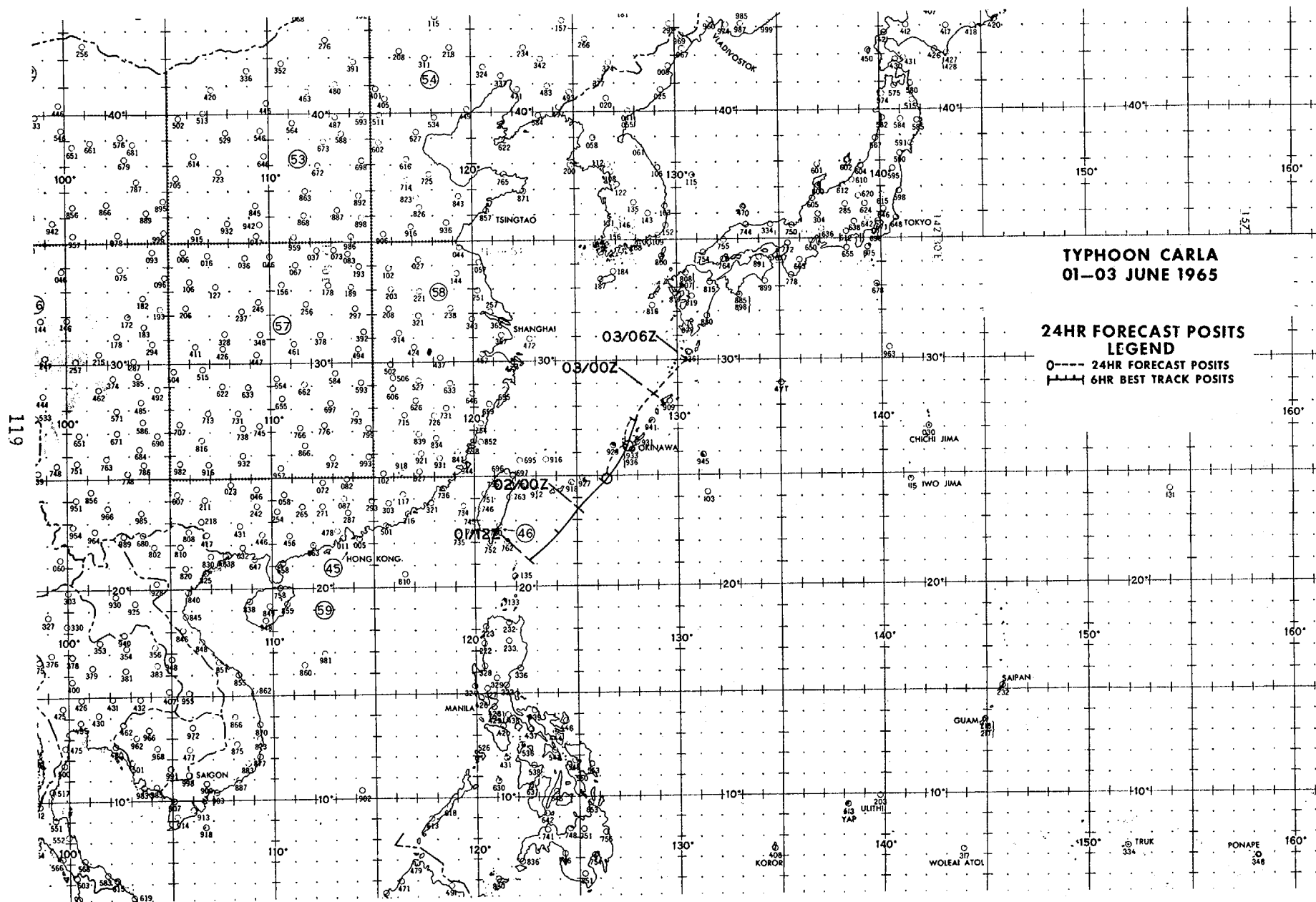


FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
14	020800Z	25.3N 126.7E	56-P-2	692mb	65	70	998	3066	16/10	EYE CIRC 25 MI DIA. 700MB CNTR BEARS 037 DEG 22 MI
15	020915Z	25.8N 127.2E	LND RDR	--	--	--	--	---	--/--	KADENA RDR
16	020930Z	25.8N 127.3E	LND RDR	--	--	--	--	---	--/--	KADENA RDR
17	021015Z	26.1N 127.4E	LND RDR	--	--	--	--	---	--/--	KADENA RDR
18	021030Z	26.2N 127.1E	LND RDR	--	--	--	--	---	--/--	KADENA RDR
19	021500Z	26.5N 127.6E	LND RDR	--	--	--	--	---	--/--	KADENA RDR
20	021505Z	27.1N 126.9E	VW1-P-20	6000ft	35	--	--	---	--/--	CNTR POORLY DEFINED
21	021530Z	26.6N 127.7E	LND RDR	--	--	--	--	---	--/--	DIA 4 MI VERY WK. KADENA RDR
22	021620Z	26.8N 127.9E	LND RDR	--	--	--	--	---	--/--	KADENA RDR
23	022050Z	27.9N 128.1E	VW1-R-10	5000ft	--	35	--	---	--/--	CNTR POORLY DEFINED. IRREGULAR SHAPE NO WALL CLD
24	030219Z	29.0N 129.5E	TIROS	--	--	--	--	---	--/--	STAGE B, DIA X, BNDS X

TYPHOON CARLA 01 JUNE-03 JUNE 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
011200Z	21.3N	122.7E	-----	-----
011800Z	22.4N	124.2E	-----	-----
020000Z	23.5N	125.1E	-----	-----
020600Z	24.8N	126.4E	-----	-----
021200Z	26.3N	127.4E	214-96	-----
021800Z	27.4N	128.0E	196-78	-----
030000Z	28.7N	128.9E	244-193	-----
030600Z	30.1N	130.4E	062-237	-----

AVERAGE 24 HOUR ERROR 151 MI



TYPHOON DINAH - 100600Z TO 200000Z JUNE

I. DATA

A. Statistics

1. Number of warnings issued - 37
2. Number of warnings with typhoon intensity - 24
3. Total distance traveled during tropical warning period - 2795 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 932mbs at 170300Z
2. Minimum observed 700mb height - 2499m. at 170300Z
3. Maximum surface wind - 160 kts (From Best Track)
4. Maximum radius of surface circulation - 525 mi

II. DEVELOPMENT

A. Initial impetus - Surge in S. Hemisphere indraft

B. Initial surface vortex

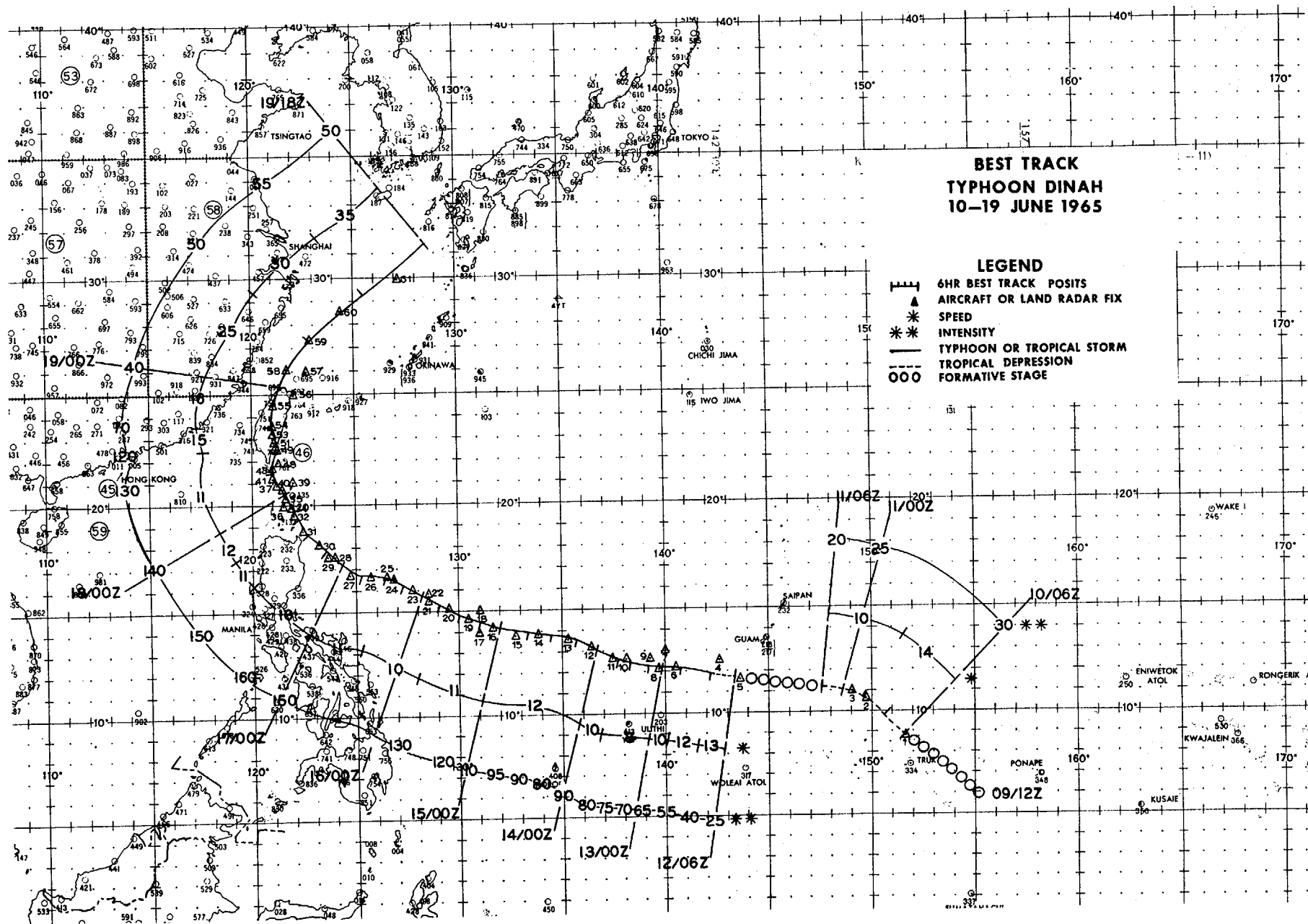
1. Junction vortex at 091200Z
2. Surface pressure less than 1009mbs

C. 200mb flow above surface vortex

1. Initial - easterly
2. Upon reaching typhoon intensity - cyclonic outdraft

III. FINAL DISPOSITION

A. Became extratropical



## EYE FIXES TYPHOON DINAH

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	100556Z	08.9N 151.6E	54-P-UNK	700mb	31	30	1004	3085	15/U	EYE CIRC 15 MI DIA WALL CLD N & NW 12 MI THICK
2	101625Z	10.6N 149.7E	VW1-P-P5	1500ft	--	--	1003	---	22/16	SECOND CNTR AT 09.6N 150.2E MIN SLP 1004
3	110056Z	11.0N 149.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 5, BNDS 1
4	120050Z	12.5N 142.5E	TIROS	--	--	--	--	---	--/--	STAGE D, DIA 5, BNDS 1 SOME CI OUTFLOW
5	120455Z	11.6N 143.6E	VW1-P-UNK	1200ft	--	25	1004	3027	26/19	CNTR OPEN E QUAD
6	122030Z	12.2N 140.4E	56-P-P1	700mb	50	65	1002	3088	10/10	TOP OF WALL CLD 15,000 FT RDR EYE 340 DEG 4 MI FM SFC EYE
7	130037Z	13.0N 140.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 5, BNDS 2 DEF CI OUTFLOW
8	130240Z	12.1N 139.6E	56-P-P1	700mb	50	65	1001	3103	10/06	700MB EYE 240 DEG 10 MI FM SFC EYE
9	130829Z	12.6N 139.2E	VW1-P-P10	700ft	--	65	992	---	24/19	EYE CIRC 14 MI DIA OPEN TO NW
10	131445Z	12.6N 138.1E	VW1-R-P3	700mb	--	--	--	---	--/--	
11	132022Z	12.6N 137.5E	56-P-P2	700mb	30	65	993	3063	14/09	RDR EYE 7 MI NW OF SFC EYE
12	140200Z	13.2N 136.4E	56-P-P2	700mb	50	100	989	3027	20/14	RDR EYE 8 MI FM SFC EYE
13	140853Z	13.6N 135.2E	VW1-P-10	1000ft	--	80	988	---	24/19	EYE ELIP N-S 22 X 17 MI WALL CLD 5 MI THICK

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
14	141415Z	13.9N 133.8E	VW1-R-15	10000ft	--	--	--	---	--/--	EYE ELIP N-S 22 X 17 MI WALL CLD APPEARS BRKN N QUAD
15	142100Z	13.9N 132.6E	56-P-P1	700mb	65	85	--	2819	17/11	SFC CALM CNTR 5 MI DIA
16	150130Z	14.3N 131.7E	56-P-P3	700mb	75	120	--	2707	20/14	CONCENTRIC EYES OUTER 16 MI DIA INNER 8 MI DIA
17	150221Z	14.0N 131.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 5 PLUS, BNDS 3
18	150511Z	15.0N 131.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 5, BNDS 4 EYE VSBL
123 19	150940Z	14.7N 130.4E	VW1-R-5	1000ft	--	70	--	---	--/--	SOLID WALL CLD EYE CIRC 7 MI DIA
20	151445Z	15.1N 129.6E	VW1-R-10	10500ft	55	--	--	---	--/--	EYE ELIP N-S 20 X 15 MI
21	152120Z	15.6N 128.4E	56-P-P2	700mb	--	130	--	2707	22/17	CONCENTRIC EYES OUTER 30 MI DIA INNER 5 MI DIA
22	160212Z	15.8N 128.4E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 5, BNDS 4 EYE VSBL
23	160300Z	16.0N 127.6E	56-P-P2	700mb	--	130	--	2661	20/15	EYE CIRC 12 MI DIA
24	160900Z	16.4N 126.8E	VW1-R-10	10000ft	--	--	--	---	--/--	EYE CIRC 10 MI DIA CLSD ALL QUADS
25	161100Z	16.6N 126.5E	VW1-R-UNK	700mb	--	--	--	---	--/--	
26	161455Z	16.6N 125.6E	VW1-R-5	10000ft	--	--	--	---	--/--	EYE CIRC 12 MI DIA CLSD WALL CLD 7 MI THICK
27	162100Z	16.8N 124.7E	56-P-P3	700mb	120	130	937	2548	15/14	EYE ELIP N-S 12 X 8 MI WALL CLD SOLID

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
28	170158Z	17.5N 124.0E	TIROS	--	--	--	--	----	--/--	STAGE X, DIA 5, BNDS 4
29	170300Z	17.5N 123.8E	56-P-P3	700mb	120	200	932	2499	15/15	EYE CIRC 8 MI DIA WALL CLD SOLID 3 MI THICK
30	170900Z	18.1N 123.2E	VW1-R-5	8000ft	--	--	--	----	--/--	EYE DIA 15 MI
31	171445Z	18.7N 122.5E	VW1-R-5	8500ft	--	--	--	----	--/--	EYE CIRC 17 MI DIA WALL CLD BRKN NNW
32	171900Z	19.4N 122.0E	LND RDR	--	--	--	--	----	--/--	HIGH CLUB RDR
33	172025Z	19.6N 121.9E	LND RDR	--	--	--	--	----	--/--	HIGH CLUB RDR
34	172130Z	19.9N 121.8E	56-P-F1	700mb	--	150	943	2579	17/17	EYE CIRC 10 MI DIA
35	172200Z	20.3N 121.6E	LND RDR	--	--	--	--	----	--/--	HIGH CLUB RDR
36	172248Z	20.0N 121.5E	LND RDR	--	--	--	--	----	--/--	LAOAG RDR
37	180000Z	20.5N 121.5E	LND RDR	--	--	--	--	----	--/--	HIGH CLUB RDR
38	180150Z	20.8N 121.4E	LND RDR	--	--	--	--	----	--/--	HIGH CLUB RDR
39	180152Z	21.0N 122.0E	TIROS	--	--	--	--	----	--/--	STAGE X, DIA 5 PLUS, BNDS 3 PLUS
40	180250Z	20.9N 121.2E	56-R-P2	700mb	100+	100	--	----	--/--	ALMOST CONCENTRIC EYE FDR BNDS OUT 60 MI
41	180400Z	21.1N 121.0E	LND RDR	--	--	--	--	----	--/--	HIGH CLUB RDR
42	180417Z	21.2N 121.2E	ACFT RDR	22000ft	--	--	--	----	--/--	
43	180600Z	21.4N 121.0E	LND RDR	--	--	--	--	----	--/--	HIGH CLUB RDR



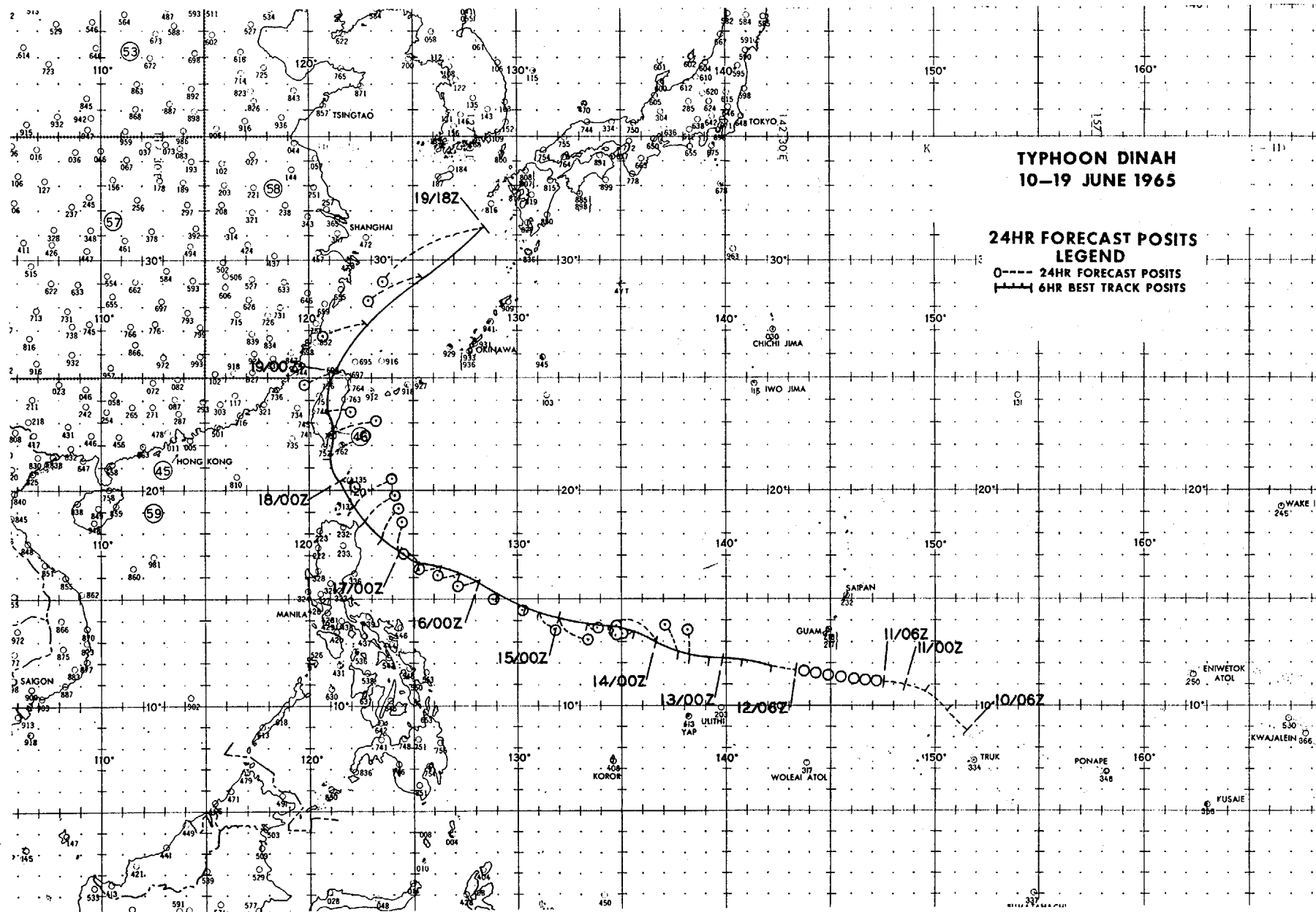
FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
44	180700Z	21.5N 121.1E	LND RDR	--	--	--	--	---	--/--	HIGH CLUB RDR
45	180745Z	21.7N 121.0E	VW1-R-2	10000ft	--	--	--	---	--/--	EYE 8 MI DIA WALL CLDS ALL QUADS THICKNESS 3 MI N, 2 MI E, 3 MI S, 6 MI W
46	180800Z	21.7N 121.1E	LND RDR	--	--	--	--	---	--/--	HIGH CLUB RDR
47	180845Z	21.7N 121.0E	VW1-R-2	10000ft	40	55	--	---	--/--	EYE APPEARED STATIONARY LAST HOUR
48	181000Z	22.0N 121.2E	LND RDR	--	--	--	--	---	--/--	
49	181100Z	22.4N 121.2E	LND RDR	--	--	--	--	---	--/--	SAD POKER RDR
50	181300Z	22.5N 121.2E	LND RDR	--	--	--	--	---	--/--	SAD POKER RDR
51	181454Z	22.8N 121.1E	VW1-R-3	9000ft	--	--	--	---	--/--	EYE ELIP N-S 8 X 6 W SIDE WALL CLC OVER LND
52	181537Z	22.7N 121.1E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
53	181700Z	23.1N 121.1E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
54	181900Z	23.5N 121.0E	LND RDR	--	--	--	--	---	--/--	TAKANGSHAN & WEIPU RDRS EYE DISSIPATED
55	182200Z	24.6N 121.1E	56-P-F2	500mb	25	--	--	---	-05/-07	500MB WND CNTR REPORTED CNTR OVER LND
56	190144Z	25.0N 122.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 3, BNDS 1
57	190200Z	26.0N 122.6E	LND RDR	--	--	--	--	---	--/--	SHIHMEN RDR
58	190206Z	26.1N 121.6E	56-P-P2	700mb	40	45	1001	3075	10/09	SFC WND CNTR REPORTED CLD CNTR AT 26.1N 122.8E AT 190134Z HAD WALL CLD & EYE

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
59	190500Z	27.4N 122.8E	LND RDR	--	--	--	--	----	--/--	
60	190932Z	28.6N 124.4E	VW1-P-5	800ft	--	55	991	----	--/--	PARTIAL WALL CLD 5 MI THICK NE QUAD CNTR ELIP N-S 15 X 8 IN STRATIFORM CLDS
61	191435Z	30.0N 127.1E	VW1-P-15	1500ft	--	50	998	----	22/15	CNTR DIFFUSE

TYPHOON DINAH 10 JUNE-19 JUNE 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
100600Z	08.9N	151.5E	-----	-----
101200Z	09.8N	150.5E	-----	-----
101800Z	10.7N	149.5E	-----	-----
110000Z	11.0N	148.5E	-----	-----
110600Z	11.2N	147.5E	-----	-----
120600Z	11.7N	143.4E	-----	-----
121200Z	11.9N	142.1E	-----	-----
121800Z	12.2N	140.8E	-----	-----
130000Z	12.2N	139.9E	-----	-----
130600Z	12.3N	139.2E	-----	-----
131200Z	12.4N	138.3E	352-64	-----
131800Z	12.5N	137.7E	335-75	-----
140000Z	13.0N	136.7E	295-127	-----
140600Z	13.5N	135.6E	269-49	-----
141200Z	13.8N	134.5E	123-40	-----
141800Z	13.9N	133.3E	108-41	-----
150000Z	14.2N	132.0E	127-104	317-126
150600Z	14.5N	131.0E	128-67	356-67
151200Z	14.8N	130.0E	138-17	079-50
151800Z	15.3N	129.0E	186-18	068-58
160000Z	15.7N	128.1E	264-50	159-136
160600Z	16.2N	127.2E	267-62	171-120
161200Z	16.5N	126.4E	263-65	245-30
161800Z	16.6N	125.2E	307-50	326-34
170000Z	17.2N	124.3E	012-96	292-95
170600Z	17.8N	123.5E	026-104	294-105
171200Z	18.5N	122.7E	041-117	296-99
171800Z	19.3N	122.1E	056-131	347-74
180000Z	20.4N	121.5E	112-40	048-246
180600Z	21.4N	121.0E	058-120	058-266
181200Z	22.5N	121.2E	070-115	062-287
181800Z	23.7N	121.0E	103-59	070-291
190000Z	25.3N	121.3E	252-85	098-158
190600Z	27.3N	122.8E	258-119	076-195
191200Z	29.2N	125.3E	249-146	103-89
191800Z	31.4N	128.5E	243-295	214-190

AVERAGE 24 HOUR ERROR 87 MI  
AVERAGE 48 HOUR ERROR 136 MI



TYPHOON FRED A - 070600Z TO 160000Z JULY

I. DATA

A. Statistics

1. Number of warnings issued - 36
2. Number of warnings with typhoon intensity - 27
3. Total distance traveled during tropical warning period - 2400 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 922mbs at 122120Z
2. Minimum observed 700mb height - 2350m. at 121445Z
3. Maximum surface wind - 140 kts (From Best Track)
4. Maximum radius of surface circulation - 675 mi

II. DEVELOPMENT

A. Initial impetus - Strong outdraft at 200mb after fracture of MPT

B. Initial surface vortex

1. Junction vortex at 060000Z
2. Surface pressure less than 1009mbs

C. 200mb flow above surface vortex

1. Initial - southeast
2. Upon reaching typhoon intensity - east side of anticyclone

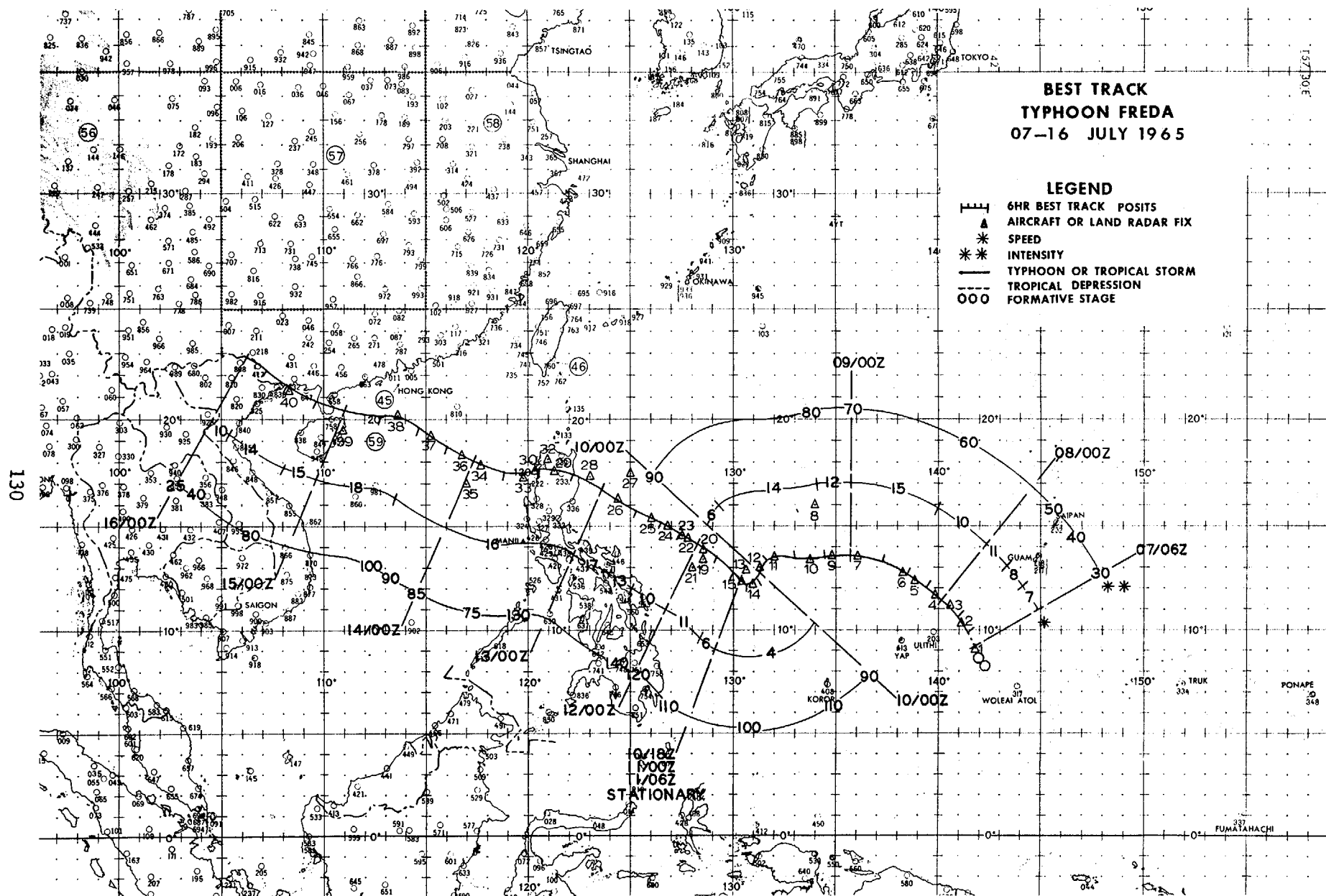
III. FINAL DISPOSITION

A. Dissipated over land

**BEST TRACK  
TYPHOON FREDA  
07-16 JULY 1965**

**LEGEND**

- 6HR BEST TRACK POSITS
- ▲ AIRCRAFT OR LAND RADAR FIX
- \* SPEED
- \*\* INTENSITY
- TYPHOON OR TROPICAL STORM
- - - TROPICAL DEPRESSION
- ooo FORMATIVE STAGE



## EYE FIXES TYPHOON FRED A

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	070500Z	09.2N 141.8E	54-P-P5	1500ft	--	30	1002	3060	23/--	EYE CIRC 20 MI DIA WELL DEFINED FDR BND N & NE
2	071500Z	10.3N 141.2E	VW1-P-P2	1100ft	45	--	997	---	26/23	EYE CIRC 11 MI DIA
3	072100Z	11.1N 140.6E	56-P-P4	700mb	32	30	996	3033	11/09	EYE NOT DEFINED
4	080200Z	11.7N 139.8E	56-P-P2	691mb	30	35	--	3030	13/09	SFC WND CENTR CIRC 10 MI DIA 700MB WIND CNTR 10 MI N OF SFC CNTR
131 5	080845Z	12.3N 138.9E	VW1-P-P3	957mb	35	50	987	---	25/20	EYE CIRC 22 MI DIA NUMEROUS FDR BNDS N & E
6	081430Z	12.7N 138.4E	VW1-R-F15	700mb	60	--	--	---	--/--	EYE CIRC 32 MI DIA SYSTEM VERY DIFFUSE
7	082100Z	13.4N 136.1E	56-P-P1	685mb	40	50	--	3036	15/09	EYE CIRC 8 MI DIA NO RDR EYE
8	090039Z	16.0N 134.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 5, BNDS 1 OVC TO S & SE
9	090247Z	13.5N 134.9E	56-P-P1	700mb	50	100	986	3011	17/13	EYE CIRC 8 MI DIA
10	090918Z	13.4N 133.7E	VW1-P-P3	962mb	--	65	986	---	27/22	EYE CIRC 10 MI DIA RDR EYE POORLY DEFINED EST 16 MI DIA BEARING 255/15 MI FM WND EYE
11	091500Z	13.6N 132.0E	VW1-R-F4	706mb	52	--	--	---	--/--	EYE CIRC 14 MI DIA
12	092100Z	13.0N 131.3E	56-P-P1	700mb	75	80	970	2890	22/16	EYE CIRC 22 MI DIA

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
13	100300Z	12.9N 130.5E	56-P-P10	700mb	80	130	968	2847	22/12	EYE CIRC 15 MI DIA
14	100903Z	12.2N 131.0E	VW1-P-P3	980ft	45	90	--	----	27/19	EYE CIRC 19 MI DIA HVY FDR BND SE QUAD 91 MI THICK
15	101445Z	12.3N 130.3E	VW1-R-P5	700mb	45	--	--	----	--/--	EYE CIRC 46 MI DIA CNTR RINGED BY FDR BNDS
16	102155Z	12.4N 130.4E	56-P-P10	700mb	70	75	966	2804	15/12	EYE CIRC 30 MI DIA PRO- BABLE SATELLITE EYE 10 MI E
17	110250Z	12.4N 130.6E	56-P-P5	700mb	70	75	961	2762	17/13	EYE CIRC 40 MI DIA RDR CNTR BEARS 310/5 MI
18	110905Z	12.4N 130.4E	VW1-P-P10	900ft	--	105	--	----	22/18	EYE CIRC 25 MI DIA RDR EYE APPEARS 10 MI ESE WND AND PRES EYE
19	111515Z	13.4N 128.6E	VW1-R-F15	700mb	--	--	--	----	--/--	EYE CIRC 25 MI DIA
20	112125Z	13.9N 128.6E	56-P-P1	700mb	90	120	940	2542	17/12	EYE CIRC 25 MI DIA SFC CALM 10 MI DIA
21	120206Z	13.0N 128.0E	TIROS	--	--	--	--	----	--/--	STAGE X, DIA 7, BNDS 3 PLUS
22	120300Z	14.5N 127.8E	56-P-P20	700mb	120	140	934	2432	20/14	EYE CIRC 25 MI DIA
23	120343Z	14.6N 127.6E	VW1-R-U	10,000ft	--	--	--	----	--/--	EYE OPEN NW QUAD
24	120900Z	15.0N 126.9E	VW1-R-P5	950ft	92	120	--	----	24/17	EYE ELIP 20 X 16 NE-SW
25	121445Z	15.3N 126.0E	VW1-P-P5	720mb	115	--	--	2350	18/12	EYE ELIP 18 X 14 E-W
26	122120Z	16.3N 124.4E	56-P-P4	700mb	120	100	922	2402	18/17	EYE CIRC 10 MI DIA RDR EYE INDEF

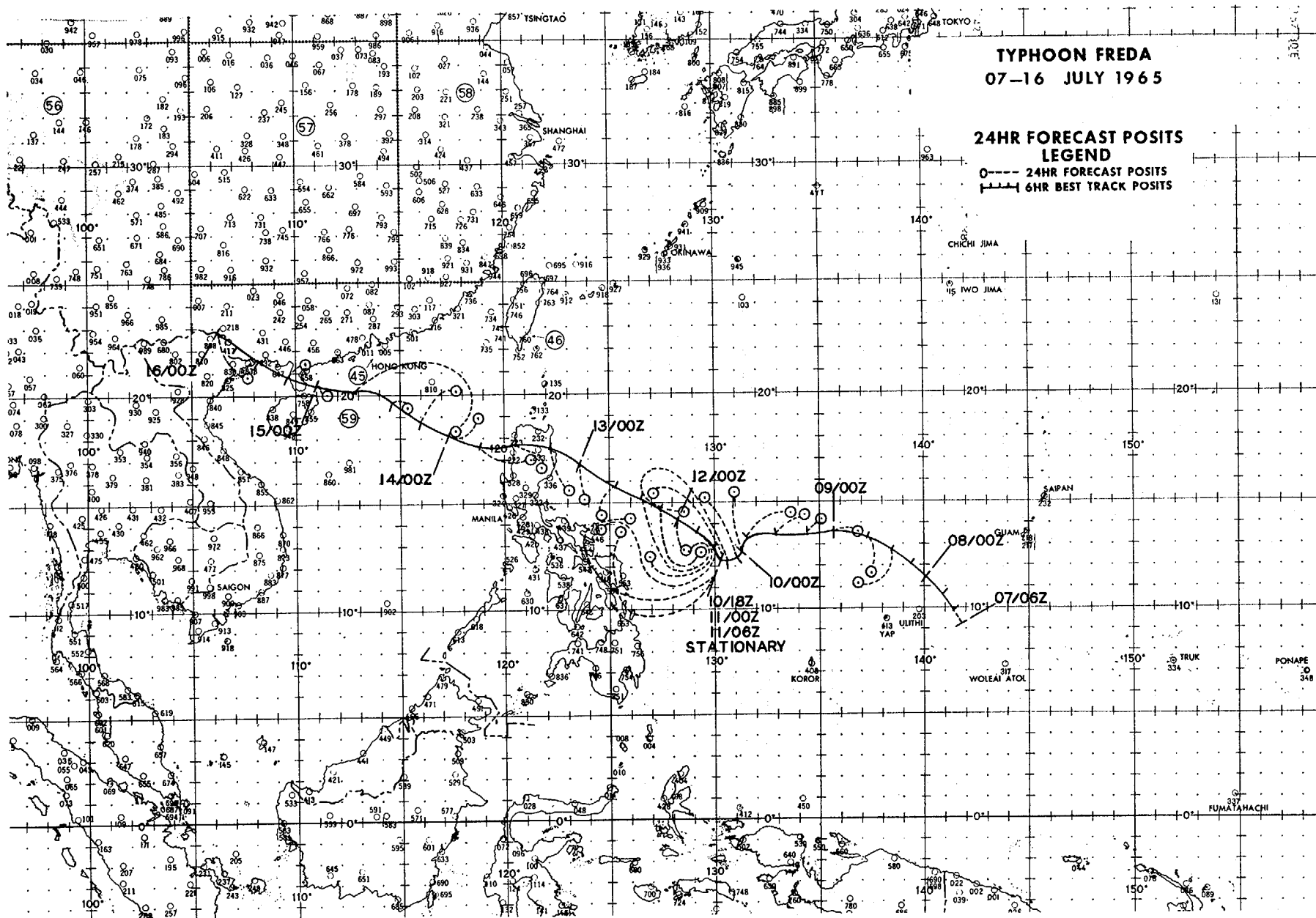


FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
27	130158Z	17.5N 125.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 8 PLUS, BNDS 3 PLUS
28	130300Z	17.3N 123.0E	56-P-P1	700mb	120	150	928	2451	19/16	EYE CIRC 700MB WND CNTR 17.0N 122.9E EYE BREAKING UP
29	130845Z	17.6N 121.3E	VW1-R-F15	1200ft	--	65	--	---	--/--	EYE CIRC 15 MI DIA CNTR OVER LUZON BREAKING UP CNTR DIFFICULT TO DISCERN
30	131030Z	17.6N 120.3E	VW1-R-U	7500ft	--	--	--	---	--/--	CNTR HARD TO DEFINE
31	131120Z	17.8N 121.1E	LND RDR	--	--	--	--	---	--/--	LAOAG RDR
32	131215Z	18.1N 121.0E	LND RDR	--	--	--	--	---	--/--	PORO PT. RDR
33	131445Z	17.3N 119.8E	VW1-R-P5	UNK	--	--	--	---	--/--	EYE CIRC 30 MI DIA. STM APPEARS TO BE REORGANIZING
34	132240Z	17.9N 117.6E	56-P-F1	700mb	67	60	965	2783	14/11	EYE INDEF SFC CALM THIS POSIT
35	140147Z	17.0N 117.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 7, BNDS 3
36	140300Z	18.3N 116.8E	56-P-F3	700mb	70	55	964	2777	16/12	EYE INDEF SFC CALM THIS POSIT
37	140855Z	19.3N 115.3E	VW1-P-P3	1500ft	--	95	962	---	25/23	EYE HOOK SHAPED OPEN S-W 15 MI DIA WND EYE BEARING 135/13 MI
38	141445Z	20.2N 113.8E	VW1-R-F10	700mb	60	--	--	---	--/--	EYE HOOK SHAPED. OPEN S
39	150142Z	19.5N 111.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 6, BNDS 3
40	151500Z	21.3N 108.2E	VW1-R-L3	700mb	20	--	--	---	--/--	CNTR POSIT EST BY SPIRAL OVERLAY

TYPHOON FRED A 07 JULY-16 JULY 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
070600Z	09.3N	141.8E	-----	-----
071200Z	09.9N	141.4E	-----	-----
071800Z	10.7N	140.9E	-----	-----
080000Z	11.4N	140.1E	-----	-----
080600Z	12.1N	139.4E	-----	-----
081200Z	12.6N	138.5E	230-132	-----
081800Z	13.2N	137.2E	170-93	-----
090000Z	13.5N	135.6E	088-69	-----
090600Z	13.5N	134.4E	045-50	-----
091200Z	13.4N	133.0E	053-94	-----
091800Z	13.3N	131.6E	057-136	099-118
100000Z	12.8N	131.3E	352-157	040-159
100600Z	12.4N	131.2E	331-190	349-204
101200Z	12.2N	130.7E	318-195	345-237
101800Z	12.3N	130.3E	311-263	341-246
110000Z	12.3N	130.3E	293-284	320-372
110600Z	12.3N	130.3E	283-300	306-412
111200Z	12.8N	130.0E	282-322	306-410
111800Z	13.6N	129.2E	243-152	305-450
120000Z	14.2N	128.3E	173-81	287-415
120600Z	14.7N	127.4E	137-175	275-390
121200Z	15.2N	126.4E	138-200	273-368
121800Z	15.8N	125.2E	205-98	222-190
130000Z	16.8N	123.7E	177-97	170-198
130600Z	17.5N	122.3E	158-120	135-368
131200Z	17.6N	120.6E	130-83	132-396
131800Z	17.5N	118.9E	104-130	155-135
140000Z	18.1N	117.3E	58-106	135-141
140600Z	18.8N	116.0E	49-124	127-227
141200Z	19.7N	114.7E	130-38	116-228
141800Z	20.1N	112.8E	112-291	112-282
150000Z	20.4N	111.0E	130-37	64-177
150600Z	20.8N	109.5E	58-59	55-213
151200Z	21.4N	108.2E	-----	102-135
151800Z	22.3N	107.1E	-----	113-304
160000Z	22.8N	106.2E	144-147	-----

AVERAGE 24 HOUR ERROR 146 MI  
AVERAGE 48 HOUR ERROR 271 MI



TYPHOON HARRIET - 210000Z TO 270000Z JULY

I. DATA

A. Statistics

1. Number of warnings issued - 25
2. Number of warnings with typhoon intensity - 16
3. Total distance traveled during tropical warning period - 2080 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 973mbs at 250910Z
2. Minimum observed 700mb height - 2871m. at 252235Z
3. Maximum surface wind - 100 kts (From Best Track)
4. Maximum radius of surface circulation - 750 mi

II. DEVELOPMENT

A. Initial impetus - Low level surge in the Southern Hemisphere "trades" crossing the equator

B. Initial surface vortex

1. Junction vortex at 200000Z
2. Surface pressure less than 1007mbs

C. 200mb flow above surface vortex

1. Initial - under anticyclonic center
2. Upon reaching typhoon intensity - northeasterly flow

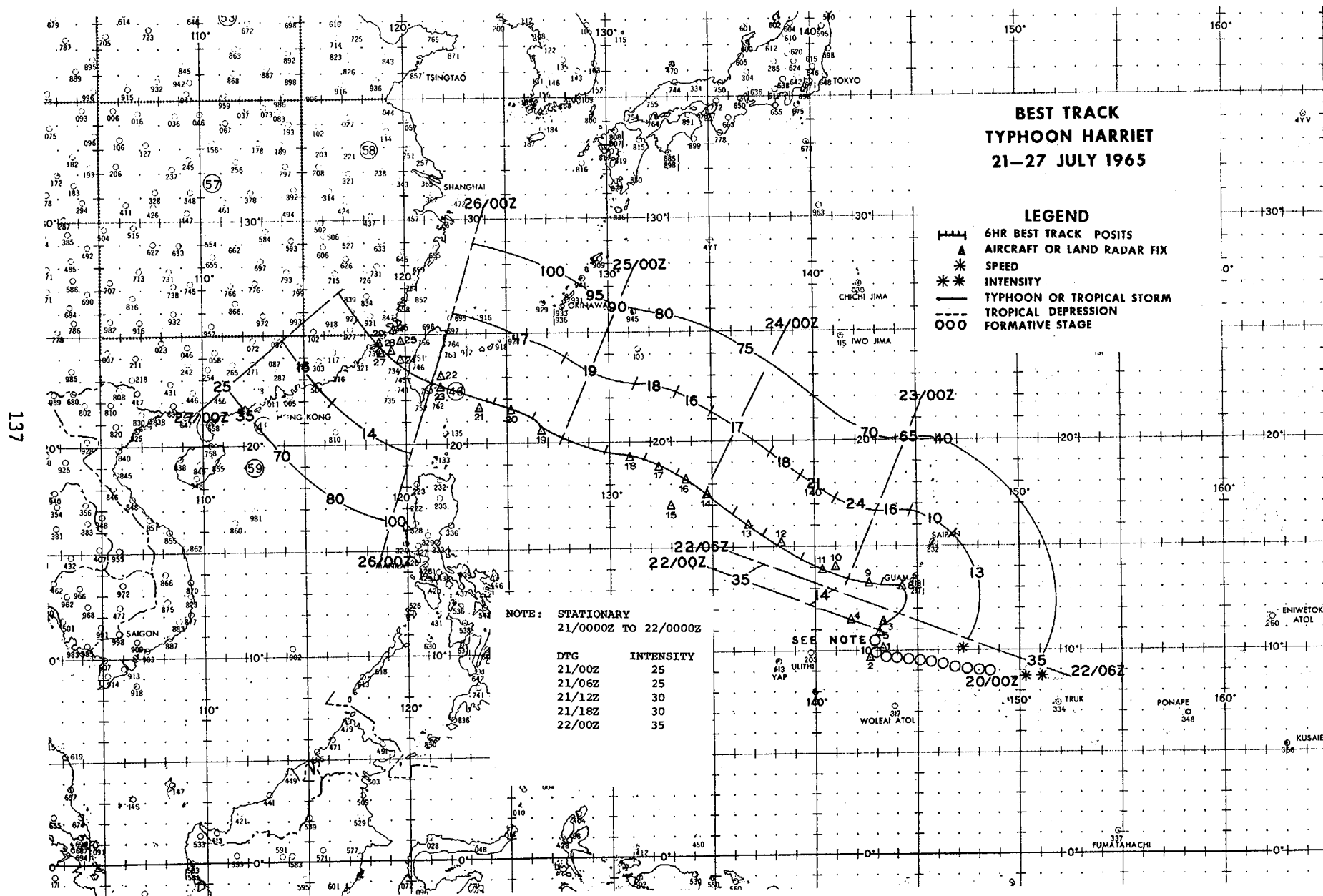
III. FINAL DISPOSITION

A. Dissipated over land

# **BEST TRACK TYPHOON HARRIET 21-27 JULY 1965**

**LEGEND**

- 6HR BEST TRACK POSITS
- △ AIRCRAFT OR LAND RADAR FIX
- \* SPEED
- \* \* INTENSITY
- TYPHOON OR TROPICAL STORM
- - - TROPICAL DEPRESSION
- ooo FORMATIVE STAGE



## EYE FIXES TYPHOON HARRIET

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	202045Z	10.1N 143.4E	VW1-P-U	1500ft	--	--	1001	----	22/18	
2	210245Z	09.8N 142.7E	VW1-P-U	1500ft	--	--	1000	----	25/20	NEG WALL CLDS NEG FDR BNDS
3	210845Z	11.3N 143.3E	VW1-P-F10	965mb	--	20	999	----	25/14	CNTR CIRC NEG POS WALL CLD
4	211430Z	11.4N 141.8E	VW1-P-F5	723mb	36	--	--	3060	13/12	RDR CNTR 28 MI NE PRES CNTR
5	220015Z	10.9N 143.1E	56-P-F5	1500ft	28	35	1000	----	--/--	INDEF WALL CLD
6	220031Z	07.5N 140.0E	TIROS	--	--	--	--	----	--/--	EVIDENCE OF CIRCN AROUND 140E EXTENSIVE OVC AREA 02N TO 13N, 130 TO 154E
7	220300Z	11.3N 143.4E	56-P-F5	1500ft	38	35	998	----	--/--	
8	220845Z	13.0N 144.3E	VW1-P-F5	1400ft	--	35	992	----	--/--	CNTR VERY VAGUE NEG WALL CLDS
9	222120Z	13.2N 142.6E	56-P-P10	682mb	25	40	999	3051	10/7	
10	230026Z	14.0N 141.0E	TIROS	--	--	--	--	----	--/--	DIA 5, BNDS 3, EYE VSBL
11	230245Z	13.9N 140.4E	56-P-P3	679mb	47	70	993	3030	12/--	ILL DEFINED
12	230906Z	15.1N 138.3E	VW1-P-P2	1500ft	--	40	--	----	--/--	
13	231445Z	16.0N 136.8E	VW1-P-P5	1500ft	50	--	989	----	--/--	CNTR 11 MI ACROSS NEG WALL CLD
14	232333Z	17.6N 134.8E	54-P-P3	681mb	45	70	986	2984	15/--	
15	240016Z	17.0N 133.0E	TIROS	--	--	--	--	----	--/--	DIA 5, BNDS 3

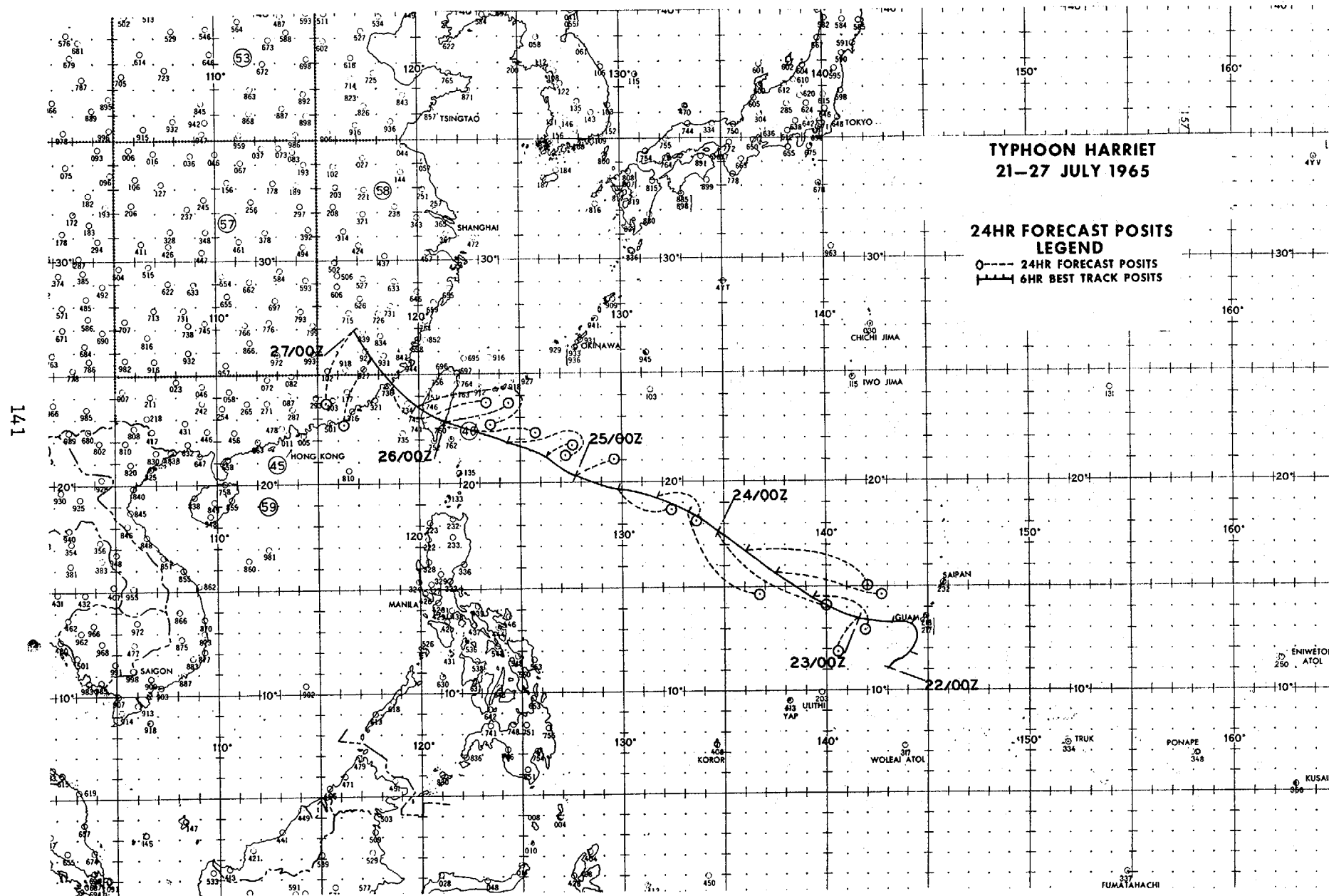
FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
16	240300Z	18.1N 133.8E	54-P-U	682mb	71	80	989	2975	16/--	WND EYE DIA 50 MI
17	240915Z	18.8N 132.4E	VW1-P-P5	943mb	48	60	982	---	26/20	CNTR CIRC 20 MI
18	241450Z	19.3N 131.0E	VW1-P-P5	702mb	55	--	--	2947	13/07	CNTR CIRC 30 MI
19	250300Z	20.6N 126.7E	56-P-P2	700mb	88	75	978	2908	16/11	CNTR DIA 40 MI
20	250910Z	21.5N 125.2E	VW1-P-P3	938mb	--	100	973	---	25/20	CNTR ELIP 30 X 20 NNE-SSW NEG WALL CLD
21	251435Z	21.7N 123.6E	VW1-P-F5	--	--	--	--	---	--/--	NO DEFINED RDR CNTR
22	252230Z	23.1N 121.8E	LND RDR	--	--	--	--	---	--/--	
23	252235Z	22.7N 121.8E	56-P-P1	700mb	55	35	--	2871	14/10	EYE CIRC 7 MI DIA WALL CLD N,W, & S 3 MI THICK
24	260245Z	23.9N 119.8E	56-P-F1	700mb	80	70	977	2902	12/10	INDEF WALL CLD
25	260514Z	24.7N 119.8E	LND RDR	--	--	--	--	---	--/--	
26	260600Z	25.2N 119.4E	LND RDR	--	--	--	--	---	--/--	
27	260925Z	24.1N 118.9E	VW1-R-F5	--	--	--	--	---	--/--	EYE CIRC DIA 31 MI
28	260954Z	24.3N 119.3E	LND RDR	--	--	--	--	---	--/--	
29	261330Z	24.6N 118.6E	VW1-R-F5	--	--	--	--	---	--/--	CNTR ON SHORE

TYPHOON HARRIET 21 JULY-27 JULY 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
210000Z	11.0N	143.0E	-----	-----
210600Z	11.0N	143.0E	-----	-----
211200Z	11.0N	143.0E	-----	-----
211800Z	11.0N	143.0E	-----	-----
220000Z	11.0N	143.0E	-----	-----
220600Z	11.8N	144.1E	-----	-----
221200Z	13.1N	144.1E	-----	-----
221800Z	13.2N	143.1E	-----	-----
230000Z	13.4N	141.5E	215-111	-----
230600Z	14.4N	139.3E	120-175	-----
231200Z	15.5N	137.5E	100-306	-----
231800Z	16.6N	136.0E	105-364	-----
240000Z	17.6N	134.7E	125-375	159-342
240600Z	18.4N	133.2E	138-304	137-430
241200Z	19.1N	131.6E	120-135	117-482
241800Z	19.6N	129.8E	113-156	118-553
250000Z	20.2N	127.8E	063-108	129-595
250600Z	21.1N	126.1E	063-90	132-500
251200Z	21.8N	124.3E	102-155	113-334
251800Z	22.3N	122.7E	089-163	112-354
260000Z	22.8N	121.2E	075-190	078-238
260600Z	23.4N	119.8E	240-90	066-225
261200Z	24.4N	118.7E	202-48	090-288
261800Z	25.6N	117.6E	204-186	080-305
270000Z	26.9N	116.7E	202-210	089-288

AVERAGE 24 HOUR ERROR 186 MI  
AVERAGE 48 HOUR ERROR 380 MI





TYPHOON JEAN - 260600Z JULY TO 070000Z AUGUST

I. DATA

A. Statistics

1. Number of warnings issued - 41
2. Number of warnings with typhoon intensity - 27
3. Total distance traveled during tropical warning period - 3565 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 940mbs at 040300Z
2. Minimum observed 700mb height - 2522m. at 040850Z
3. Maximum surface wind - 140 kts (From Best Track)
4. Maximum radius of surface circulation - 625 mi

II. DEVELOPMENT

A. Initial impetus - Surge in trades followed by movement south of a deep Polar trough which prevented development by differential steering of surface and mid level vortices. When the system moved west of the Polar trough and under 200mb divergence, the typhoon developed.

B. Initial surface vortex

1. Junction vortex at 220600Z
2. Surface pressure less than 1008mbs

C. 200mb flow above surface vortex

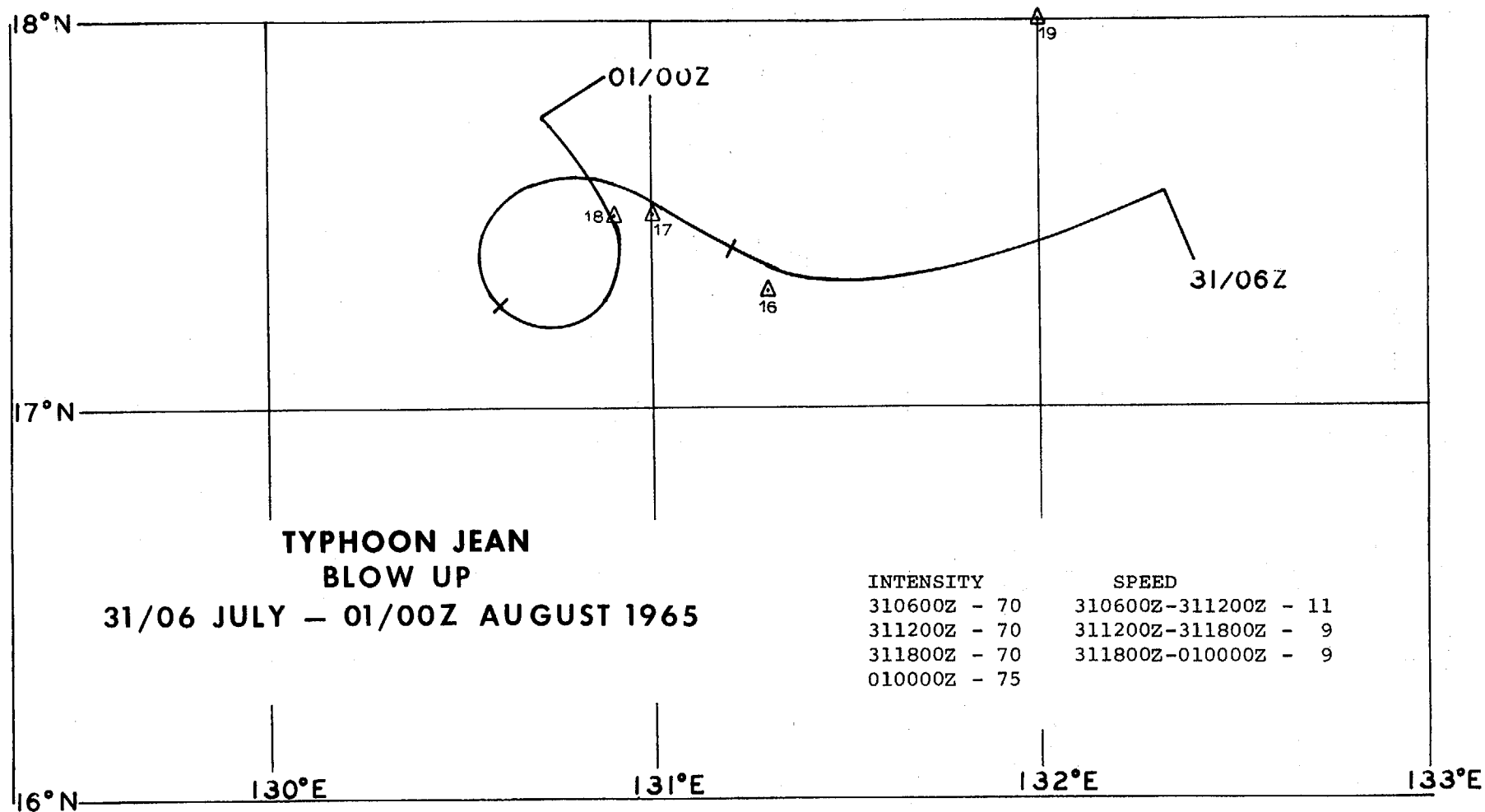
1. Initial - northeasterly
2. Upon reaching typhoon intensity - northeasterly divergent

flow

III. FINAL DISPOSITION

A. Became extratropical





## EYE FIXES TYPHOON JEAN

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	260317Z	09.3N 155.8E	56-P-P6	1500ft	29	25	1003	3124	25/--	EYE CIRC 20 MI DIA
2	261502Z	10.1N 153.3E	VW1-P-P5	1450ft	40	--	1001	3030	12/05	EYE CIRC 30 MI DIA MAX TOPS EXCEED 40000 FT
3	262304Z	10.5N 152.6E	56-P-F10	953mb	22	20	1005	----	24/21	EYE INDEF
4	270105Z	10.0N 149.0E	TIROS	--	--	--	--	----	--/--	STAGE B, DIA X, BNDS X. CIRC OVC AREA APPROX 4 DEG DIA
5	270250Z	11.2N 150.9E	56-P-F10	955mb	22	20	1002	----	25/21	EYE INDEF
6	270845Z	11.6N 150.7E	VW1-P-F5	1500ft	25	18	1000	----	--/--	VIS VORTEX ONLY
7	271538Z	12.3N 147.0E	VW1-P-LU	1500ft	--	--	--	----	--/--	APPARENT VIS VORTEX THIS POSIT
8	272245Z	12.1N 146.5E	56-P-P4	700mb	20	12	1005	3112	11/08	CNTR CIRC 25 MI DIA
9	280300Z	13.5N 146.1E	56-P-P4	412M	16	15	1005	----	24/20	NEG EYE NO INDICATION OTHER THAN LGT SFC WND
10	280400Z	12.1N 144.3E	LND RDR	--	--	--	--	----	--/--	SANTA ROSA RDR
11	280630Z	12.5N 144.3E	LND RDR	--	--	--	--	----	--/--	SANTA ROSA RDR
12	282330Z	15.6N 141.8E	56-P-L3	953mb	21	18	1003	----	25/22	EYE INDEF CLSD SFC CIRC ELONG E-W
13	290250Z	15.5N 140.9E	56-P-L1	951mb	22	20	1003	----	25/21	EYE INDEF SFC CIRC CLSD VERY ELONG E-W

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
14	310125Z	17.6N 133.4E	54-P-P3	700mb	30	65	995	3027	12/12	EYE CIRC 30 MI DIA
15	310240Z	17.6N 133.2E	54-P-P5	700mb	30	70	996	3027	12/11	EYE CIRC 30 MI DIA
16	311110Z	17.3N 131.3E	VW1-P-P5	265M	--	--	989	---	25/19	EYE ELIP 13 X 7 N-S
17	311425Z	17.5N 131.0E	VW1-R-P10	700mb	--	--	--	---	--/--	EYE ELIP 15 X 10 N-S
18	312150Z	17.5N 130.9E	56-P-P2	700mb	58	65	987	2987	12/11	EYE CIRC 23 MI DIA SFC & 700MB WND CNTR VERTICAL, RDR EYE BEARS 220/06 MI
19	010158Z	18.0N 132.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 4, BNDS 3
20	010300Z	18.2N 130.6E	56-P-P2	700mb	60	75	984	2957	--/--	700MB WND CNTR 060/12 MI FM SFC CNTR
21	010901Z	18.9N 130.5E	VW1-P-P3	946mb	60	60	982	---	--/--	NO WALL CLD FDR BNDS ALL QUADS
22	011445Z	19.9N 130.0E	VW1-P-P2	698mb	70	--	--	2980	12/04	CNTR CIRC 20 MI DIA
23	012100Z	20.2N 129.4E	56-P-P2	700mb	60	75	980	2929	15/10	EYE CIRC 40 MI DIA OPEN W-N- E SOLID E-S-W
24	020200Z	20.6N 129.0E	56-P-P3	700mb	55	80	979	2910	12/12	EYE CIRC 10 MI DIA SOLID ALL QUADS
25	020900Z	21.5N 128.5E	VW1-R-P3	955mb	--	60	--	---	--/--	EYE CIRC 2 MI DIA SHAPE LIKE FIGURE SIX OPEN NE
26	021447Z	22.1N 128.3E	VW1-R-P5	850mb	--	--	--	---	--/--	EYE CIRC 3 MI DIA FDR BNDS ALL QUADS
27	022215Z	22.7N 127.8E	56-P-P2	700mb	60	70	959	2829	20/14	EYE CIRC 20 MI DIA WALL CLD S & W

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
28	030240Z	23.0N 127.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 4, BNDS 3 PLUS
29	030300Z	23.2N 127.5E	56-P-P2	700mb	70	80	967	2819	20/11	EYE CIRC 20 MI DIA
30	030358Z	22.2N 127.2E	LND RDR	--	--	--	--	---	--/--	KADENA RDR
31	030710Z	23.4N 127.5E	LND RDR	--	--	--	--	---	--/--	KADENA RDR
32	030915Z	23.7N 127.5E	VW1-R-P5	700mb	--	110	--	---	--/--	EYE ELIP N-S 13 X 10 MI WALL CLD SOLID ALL QUADS
33	031040Z	23.8N 127.3E	LND RDR	--	--	--	--	---	--/--	
34	031200Z	24.1N 126.8E	LND RDR	--	--	--	--	---	--/--	
35	031445Z	24.3N 127.3E	VW1-R-F5	700mb	--	--	--	---	--/--	EYE CIRC 8 MI DIA POORLY DEFINED
36	031538Z	24.2N 127.0E	LND RDR	--	--	--	--	---	--/--	
37	031808Z	24.4N 126.9E	LND RDR	--	--	--	--	---	--/--	KADENA RDR
38	032000Z	24.8N 127.0E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
39	032100Z	25.0N 127.0E	56-P-P1	700mb	80	--	958	2740	19/13	EYE CIRC 30 MI DIA WALL CLDS OPEN N SOLID ALL OTHER QUADS
40	032300Z	25.2N 126.9E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
41	040000Z	25.4N 126.8E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
42	040212Z	25.5N 127.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 4, BNDS 4 EYE VSBL
43	040300Z	25.7N 126.8E	56-P-P3	700mb	70	140	940	2679	19/13	EYE CIRC 30 MI DIA WALL CLDS SOLID ALL QUADS XCPT N 10 MI THICK

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
44	040417Z	25.8N 127.0E	LND RDR	--	--	--	--	----	--/--	KADENA RDR
45	040723Z	26.1N 127.0E	LND RDR	--	--	--	--	----	--/--	KADENA RDR
46	040850Z	26.4N 127.0E	VW1-P-P2	688mb	58	100	--	2522	21/12	EYE ELIP NE-SW 27 X 23 MI
47	041445Z	27.0N 127.1E	VW1-R-P10	700mb	40	--	--	----	--/--	EYE CIRC 16 MI DIA WALL CLD SEMI CIRCLE ONLY 13 MI THICK
48	041537Z	27.4N 127.4E	LND RDR	--	--	--	--	----	--/--	KADENA RDR
49	041915Z	27.7N 127.6E	LND RDR	--	--	--	--	----	--/--	OKINO & KUMI SHIMA RDRS
50	042100Z	28.0N 128.0E	LND RDR	--	--	--	--	----	--/--	OKINO & KUMI SHIMA RDRS
51	042145Z	28.2N 127.9E	56-P-P2	700mb	78	150	950	2661	19/15	EYE CIRC 35 MI DIA
52	050230Z	29.0N 128.0E	56-P-P10	700mb	70	125	945	2634	19/14	EYE CIRC 20 MI DIA
53	050900Z	29.9N 128.9E	VW1-R-P2	800ft	--	--	--	----	--/--	EYE CIRC 22 MI DIA MAIN FDR BNDS SE THROUGH SW
54	051445Z	31.2N 129.5E	VW1-R-P1	700mb	--	--	--	----	--/--	EYE CIRC 20 MI DIA WALL CLD WK N QUAD
55	052115Z	32.8N 130.5E	56-P-P2	500mb	80	130	--	----	-04/-04	RDR EYE 100 DEG 12 MI FM 500MB EYE FIXED
56	060230Z	34.7N 131.3E	LND RDR	--	--	--	--	----	--/--	KASUGA RDR
57	060300Z	35.0N 131.4E	56-P-P2	500mb	60	80	--	----	--/--	FLT LVL CNTR FIXED NO RDR EYE
58	060600Z	35.8N 132.7E	LND RDR	--	--	--	--	----	--/--	KASUGA RDR



FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
59	060913Z	36.9N 133.4E	VW1-R-F2	708mb	--	--	--	---	--/--	EYE CIRC 23 MI DIA WALL CLD OPEN N & S, NOT WELL DEFINED
60	061019Z	37.5N 133.4E	VW1-P-P1	708mb	60	--	--	2923	13/10	EYE CIRC 10 MI DIA NOT WELL ORGANIZED
61	061231Z	38.3N 134.3E	VW1-R-U	--	--	--	--	---	--/--	POORLY DEFINED RDR EYE
62	062225Z	43.6N 137.7E	54-R-U	--	--	55	--	---	--/--	

TYPHOON JEAN 26 JULY-07 AUG 1965  
POSITION AND FORECAST VERIFICATION DATA

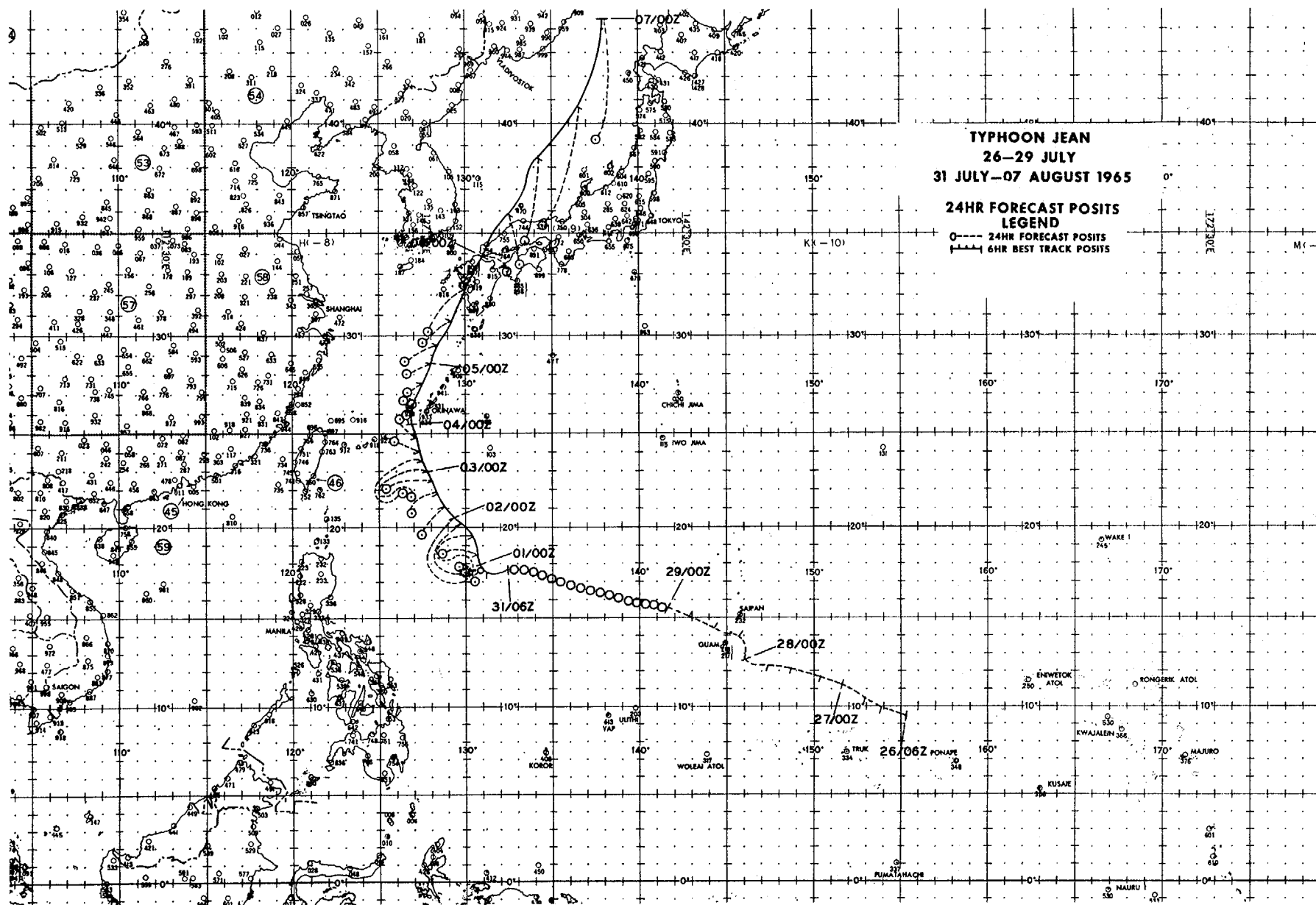
DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
260600Z	09.5N	155.3E	-----	-----
261200Z	09.9N	153.9E	-----	-----
261800Z	10.5N	152.7E	-----	-----
270000Z	11.2N	151.6E	-----	-----
270600Z	11.7N	150.3E	-----	-----
271200Z	12.1N	148.8E	-----	-----
271800Z	12.3N	147.4E	-----	-----
280000Z	12.7N	146.0E	-----	-----
280600Z	14.0N	145.5E	-----	-----
281200Z	14.4N	144.2E	-----	-----
281800Z	15.0N	142.9E	-----	-----
290000Z	15.4N	141.5E	-----	-----
310600Z	17.6N	132.3E	-----	-----
311200Z	17.4N	131.2E	-----	-----
311800Z	17.5N	131.0E	-----	-----
010000Z	17.8N	130.8E	-----	-----
010600Z	18.6N	130.5E	268-100	-----
011200Z	19.5N	130.4E	179-148	-----
011800Z	20.1N	129.7E	175-160	-----
020000Z	20.4N	129.2E	166-160	-----
020600Z	21.1N	128.6E	217-114	237-275
021200Z	21.8N	128.3E	234-100	196-290
021800Z	22.4N	128.0E	261-150	197-317
030000Z	22.9N	127.7E	204-95	200-261
030600Z	23.5N	127.5E	212-114	242-303
031200Z	24.0N	127.3E	291-93	242-286
031800Z	24.8N	127.1E	323-72	262-337
040000Z	25.4N	126.9E	344-33	217-187
040600Z	26.1N	126.8E	321-36	231-209
041200Z	26.7N	127.1E	210-34	308-160
041800Z	27.6N	127.4E	230-57	322-152
050000Z	28.6N	128.0E	248-88	282-92
050600Z	29.6N	128.4E	243-122	296-120
051200Z	30.7N	129.3E	234-112	230-196
051800Z	32.1N	130.0E	222-162	228-257

TYPHOON JEAN 26 JULY-07 AUG 1965  
POSITION AND FORECAST VERIFICATION DATA (CONT'D)

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
060000Z	33.8N	131.0E	123-90	241-251
060600Z	35.8N	132.5E	170-150	237-308
061200Z	38.3N	134.1E	189-222	218-418
061800Z	40.7N	136.5E	198-330	215-580
070000Z	44.5N	137.8E	183-337	162-526

AVERAGE 24 HOUR ERROR 128 MI

AVERAGE 48 HOUR ERROR 276 MI



TYPHOON IVY - 271800Z TO 311800Z JULY

I. DATA

A. Statistics

1. Number of warnings issued - 18
2. Number of warnings with typhoon intensity - 12
3. Total distance traveled during tropical warning period - 1100 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 991 mbs at 300915Z
2. Minimum observed 700mb height - 2996m. at 310300Z
3. Maximum surface wind - 80 kts (From Best Track)
4. Maximum radius of surface circulation - 325 mi

II. DEVELOPMENT

A. Initial impetus - Fracture of MPT (Developed in residual trough along ITCZ left by Typhoon HARRIET to the east of the Philippine Islands)

B. Initial surface vortex

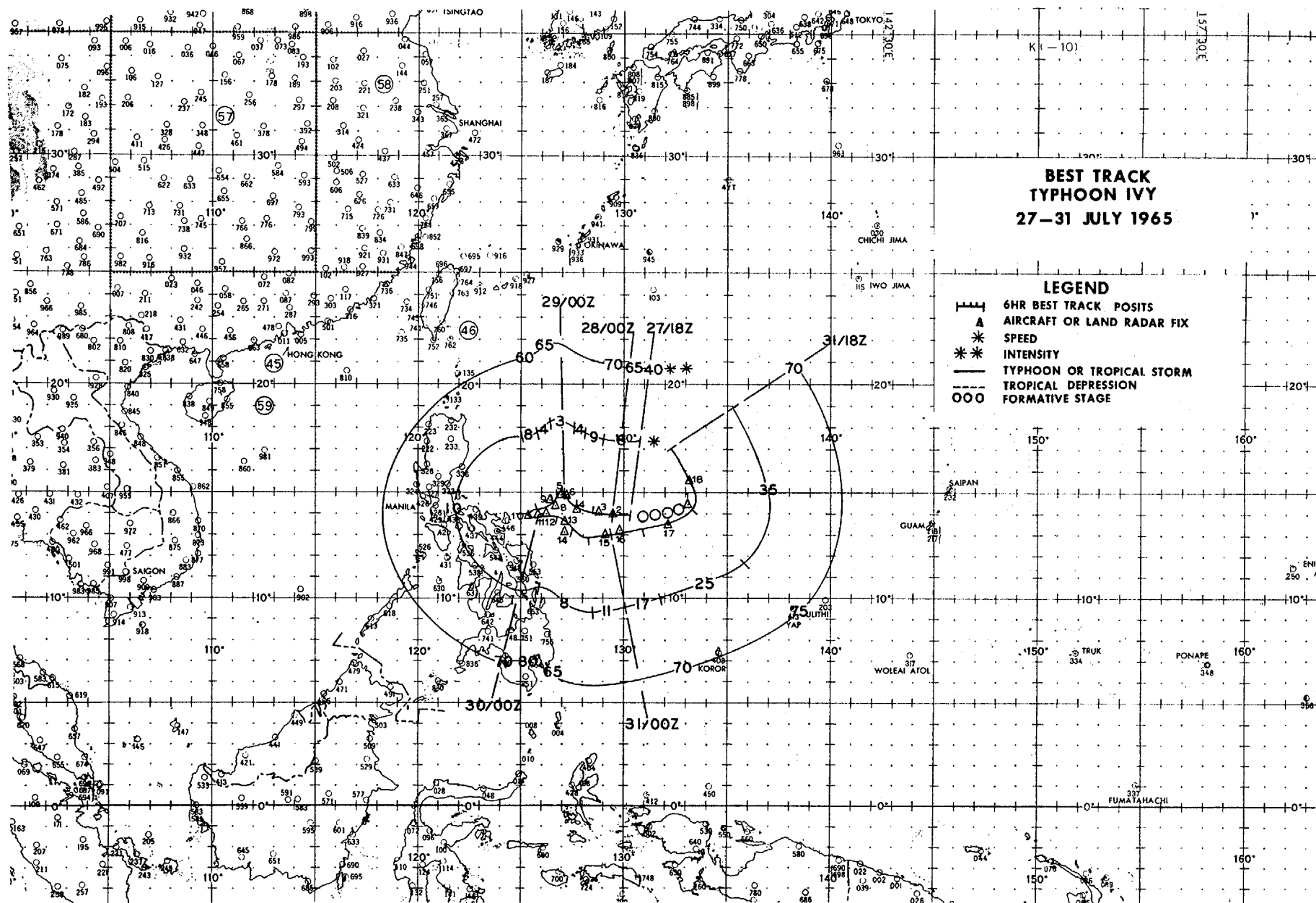
1. Junction vortex at 262100Z
2. Surface pressure less than 1008mbs

C. 200mb flow above surface vortex

1. Initial - northeasterly
2. Upon reaching typhoon intensity - northerly

III. FINAL DISPOSITION

A. Absorbed into circulation of Typhoon JEAN



## EYE FIXES TYPHOON IVY

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	262115Z	14.3N 133.1E	54-R-U	--	--	--	--	---	--/--	GOOD WALL CLD EYE ELIP 10 X 13 MI 3 OR 4 GOOD FDR BNDS
2	272200Z	14.0N 129.5E	ACFT RDR	--	--	--	--	---	--/--	USAF RDR FIX
3	280300Z	14.1N 128.9E	56-P-P5	700mb	45	70	--	3048	19/--	EYE CIRC 20 MI DIA CLDS DISORGANIZED AT 10000 FT
4	281008Z	14.2N 127.8E	VW1-P-P5	960mb	--	55	994	---	27/20	EYE CIRC 20 MI DIA
5	281445Z	14.9N 127.0E	VW1-R-F3	700mb	80	--	--	---	--/--	EYE CIRC 25 MI DIA GENERAL DSPTN OF CNTR
6	282300Z	14.9N 127.2E	56-P-F2	691mb	45	45	--	3048	14/09	EYE CIRC 10 MI DIA 700MB WND CNTR 210/15 MI FM EYE
7	290300Z	14.9N 126.9E	56-P-P2	711mb	65	45	992	3048	18/10	EYE CIRC 15 MI DIA 700MB WND CNTR 240/32 MI FM EYE
8	290910Z	14.4N 126.8E	VW1-P-F5	960mb	35	35	--	---	25/22	EYE CIRC 20 MI DIA NO WALL CLD SFC WND CNTR REPTD
9	291445Z	14.6N 126.5E	VW1-R-F10	962mb	--	--	--	---	--/--	EYE CIRC 25 MI DIA
10	292100Z	13.9N 125.3E	56-R-P4	700mb	40	--	--	---	--/--	EYE CIRC 8 MI DIA
11	300050Z	13.9N 125.9E	56-P-P2	689mb	45	70	999	3072	05/05	EYE ELIP N-S 30 X 20 MI
12	300300Z	13.9N 126.3E	56-P-P4	688mb	35	80	997	3057	11/02	SFC WND EYE 3 MI DIA RDR EYE 40 MI DIA

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
13	300915Z	13.7N 127.2E	VW1-P-P1	970mb	--	35	991	---	26/14	EYE ELIP NE-SW 37 X 26 MI WND EYE CIRC 10 MI DIA
14	301445Z	13.1N 127.2E	VW1-R-P10	700mb	30	--	--	---	--/--	EYE ELIP E-W 32 X 15 MI
15	302330Z	13.0N 129.1E	56-P-P2	722 mb	35	55	--	3011	15/10	POORLY DEFINED EYE CIRC 10 MI DIA
16	310300Z	13.2N 129.9E	56-P-P5	722mb	40	50	--	2996	14/10	RDR EYE 180/24 MI FM SFC CNTR EYE CIRC 15 MI DIA
17	310927Z	13.5N 132.2E	VW1-P-P5	958mb	--	75	994	---	24/18	EYE ELIP N-S 15 X 10 MI NUMEROUS FDR BNDS
18	311445Z	15.6N 133.3E	VW1-R-P10	1500ft	--	--	--	---	--/--	EYE ELIP E-W 20 X 18 MI APPEARS CLSD ALL QUADS

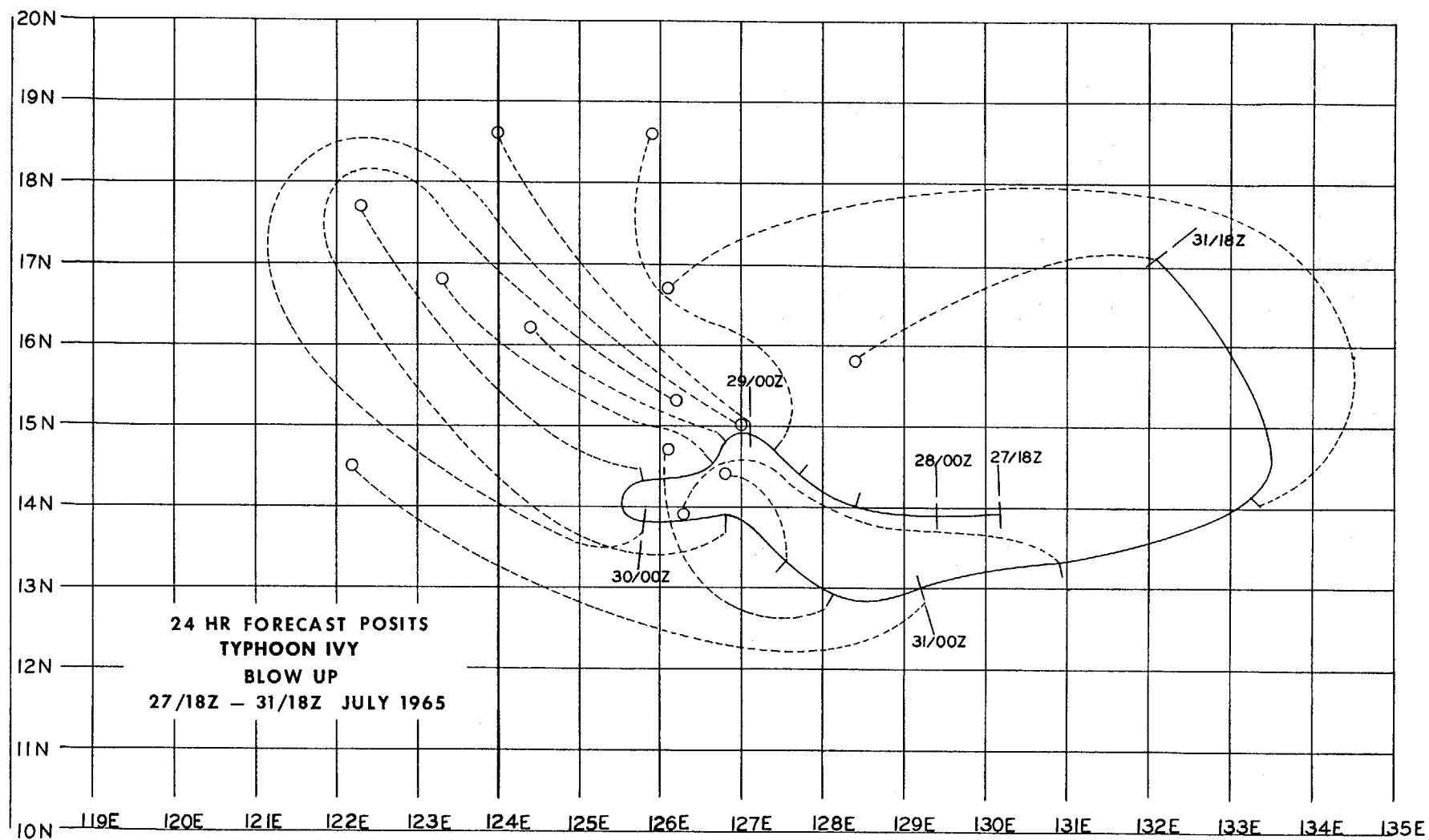


TYPHOON IVY 27 JULY-31 JULY 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
271800Z	13.9N	130.2E	-----	-----
280000Z	13.9N	129.4E	-----	-----
280600Z	14.0N	128.4E	-----	-----
281200Z	14.4N	127.7E	-----	-----
281800Z	14.7N	127.4E	339-255	-----
290000Z	14.9N	127.1E	322-285	-----
290600Z	14.8N	126.8E	302-160	-----
291200Z	14.5N	126.7E	306-233	-----
291800Z	14.3N	125.8E	315-295	-----
300000Z	13.8N	125.8E	045-98	329-614
300600Z	13.9N	126.8E	340-96	313-500
301200Z	13.3N	127.5E	328-74	315-613
301800Z	12.9N	128.1E	312-160	316-736
310000Z	13.0N	129.2E	282-424	304-365
310600Z	13.3N	130.9E	279-275	298-520
311200Z	14.1N	133.3E	291-445	278-510
311800Z	17.1N	132.1E	251-225	260-470

AVERAGE 24 HOUR ERROR 233 MI

AVERAGE 48 HOUR ERROR 541 MI



## TYPHOON LUCY - 150600Z TO 230600Z AUGUST

### I. DATA

#### A. Statistics

1. Number of warnings issued - 33
2. Number of warnings with typhoon intensity - 27
3. Total distance traveled during tropical warning period - 2583 mi

#### B. Characteristics as a typhoon

1. Minimum observed SLP - 940mbs at 200300Z
2. Minimum observed 700mb height - 2609m. at 190240Z
3. Maximum surface wind - 150 kts (From Best Track)
4. Maximum radius of surface circulation - 425 mi

### II. DEVELOPMENT

A. Initial impetus - Fracture of southwestern tip of Polar trough in mid levels.

#### B. Initial surface vortex

1. A junction vortex could be tracked northwestward from 130000Z. However, just prior to 150600Z a reconnaissance aircraft proceeding northward from the junction vortex encountered light and variable winds and then increasing westerly winds, followed by the initial fix on LUCY. Therefore, LUCY actually formed in the embedded vortex.

2. Surface pressure less than 1007mbs

#### C. 200mb flow above surface vortex

1. Initial - northeasterly
2. Upon reaching typhoon intensity - southerly

### III. FINAL DISPOSITION

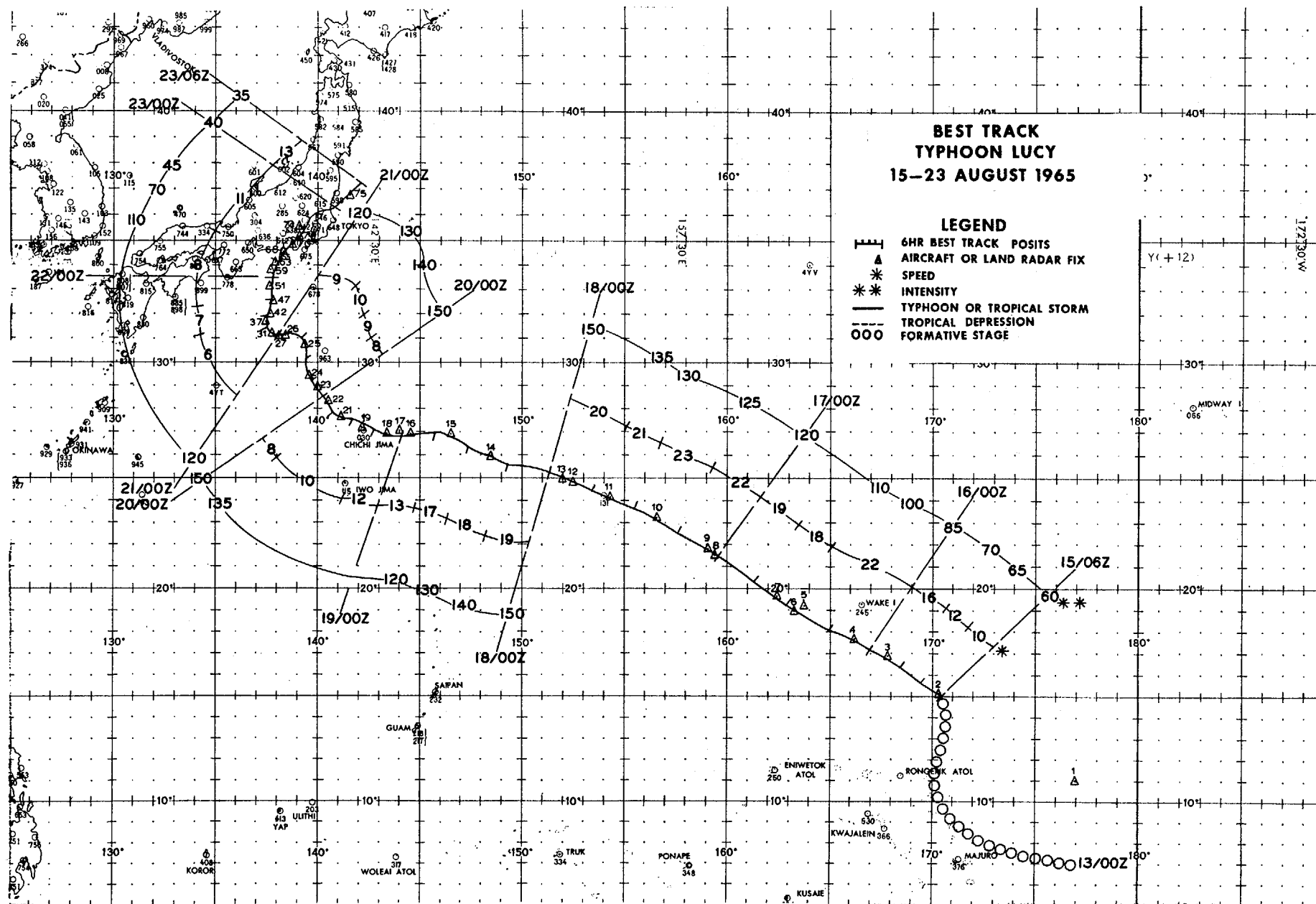
A. Became extratropical

# **BEST TRACK TYPHOON LUCY 15-23 AUGUST 1965**

**LEGEND**

- 6HR BEST TRACK POSITS
- AIRCRAFT OR LAND RADAR FIX
- SPEED
- INTENSITY
- TYPHOON OR TROPICAL STORM
- TROPICAL DEPRESSION
- FORMATIVE STAGE

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## EYE FIXES TYPHOON LUCY

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL	OBS SFC	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	112348Z	11.0N 177.0E	TIROS	--	--	--	--	---	--/--	STAGE A DIA X BNDS X OVC AREA FIVE DEG DIA
2	150610Z	15.1N 170.3E	54-P-P3	700mb	--	60	993	3054	16/--	EYE CIRC 25 MI DIA
3	152052Z	16.8N 167.8E	VW1-P-P5	750ft	--	70	993	3101	27/23	EYE CIRC 18 MI DIA
4	160250Z	17.6N 166.2E	54-P-P2	700mb	--	100	998	3088	14/--	EYE CIRC 15 MI DIA
5	160915Z	19.2N 163.8E	VW1-R-P5	700mb	--	--	--	---	--/--	EYE CIRC 22 MI DIA
6	161000Z	18.9N 163.3E	VW1-R-U	700mb	--	--	--	---	--/--	EYE REFORMED
7	161447Z	19.6N 162.4E	VW1-R-P5	700mb	--	--	--	---	--/--	EYE CIRC 13 MI DIA
8	170020Z	21.4N 159.5E	54-P-P2	700mb	--	120	993	3060	13/--	EYE CIRC 10 MI DIA
9	170215Z	21.7N 159.1E	54-P-P2	700mb	--	120	--	2990	16/--	EYE CIRC 10 MI DIA
10	170900Z	23.2N 156.6E	VW1-R-P5	1500ft	--	--	--	---	--/--	EYE CIRC 12 MI DIA
11	171445Z	24.1N 154.3E	VW1-R-P10	800mb	--	--	--	---	--/--	EYE CIRC 7 MI DIA
12	172130Z	24.8N 152.5E	54-R-P1	700mb	80	150	--	---	--/--	EYE CIRC 5 MI DIA
13	180300Z	24.9N 152.0E	54-R-P5	700mb	75	150	--	---	--/--	EYE CIRC 5 MI DIA
14	180900Z	25.9N 148.4E	VW1-R-P10	951mb	--	90	--	---	--/--	EYE ELIP 34 X 30 NW-SE
15	181445Z	26.8N 146.6E	VW1-R-P15	905mb	50	--	--	---	--/--	CONCENTRIC EYE CIRC 4 MI DIA

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
16	182100Z	26.8N 144.6E	54-P-P7	700mb	65	85	946	2630	18/14	EYE CIRC 10 MI DIA
17	190123Z	27.0N 144.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 5, BNDS 3
18	190240Z	26.9N 143.4E	54-P-P5	700mb	90	90	944	2609	18/11	EYE CIRC 20 MI DIA
19	190900Z	27.1N 142.2E	VISUAL	--	--	110	--	---	--/--	CHICHI JIMA IN S EDGE WALL CLD EST EYE 4 MI N
20	190945Z	27.3N 142.2E	VW1-R-P2	950mb	28	40	--	---	--/--	EYE CIRC 21 MI DIA
21	191445Z	27.6N 141.2E	VW1-R-P2	700mb	--	--	--	---	--/--	EYE CIRC 17 MI DIA
22	192156Z	28.3N 140.5E	54-P-P2	700mb	--	150	960	2725	14/--	EYE CIRC
23	200300Z	28.9N 140.0E	54-P-P2	700mb	70	150	940	2728	--/--	EYE CIRC 15 MI DIA
24	200845Z	29.4N 139.6E	VW1-R-P10	947mb	95	90	--	---	--/--	EYE CIRC 27 MI DIA
25	201515Z	30.7N 139.4E	VW1-R-P10	700mb	--	--	--	---	--/--	
26	202138Z	31.1N 138.3E	54-P-P2	697mb	90	70	953	2691	16/13	EYE CIRC 40 MI DIA WALL CLD WK ALL QUADS
27	210000Z	31.1N 138.0E	LND RDR	--	--	--	--	---	--/--	MT FUJI RDR EYE DIA 70 KM
28	210203Z	31.2N 137.8E	LND RDR	--	--	--	--	---	--/--	EYE CLEAR
29	210216Z	31.0N 137.5E	TIROS	--	--	--	--	---	--/--	STAGE X DIA 4 BNDS 4
30	210230Z	31.3N 137.6E	54-P-P2	700mb	85	110	953	2685	17/10	EYE CIRC 35 MI DIA WALL CLD MDT 6 MI THK ALL QUADS
31	210300Z	31.2N 137.7E	LND RDR	--	--	--	--	---	--/--	EYE DIA 40 KM
32	210400Z	31.3N 137.7E	LND RDR	--	--	--	--	---	--/--	MT FUJI RDR EYE DIA 60 KM

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
33	210500Z	31.4N 137.7E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR EYE CLEAR
34	210600Z	31.4N 137.7E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR
35	210800Z	31.6N 137.6E	LND RDR	--	--	--	--	----	--/--	EYE CLEAR EYE DIA 50 KM
36	210900Z	31.6N 137.6E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR EYE DIA 60 KM
37	210900Z	31.6N 137.4E	VW1-R-P10	207mb	60	85	--	----	--/--	EYE CIRC 32 MI DIA
38	211000Z	31.6N 137.6E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR EYE CLEAR EYE DIA 60 KM
39	211100Z	31.7N 137.5E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR EYE CLEAR EYE DIA 60 KM
40	211200Z	31.8N 137.6E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR EYE CLEAR
41	211300Z	31.8N 137.6E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR EYE CLEAR
42	211400Z	32.0N 137.7E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR EYE CLEAR EYE DIA 16 KM
43	211445Z	32.2N 138.0E	VW1-R-P15	701mb	47	--	--	----	--/--	EYE CIRC 32 MI DIA
44	211500Z	32.3N 137.8E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR EYE CLEAR EYE DIA 40 KM
45	211600Z	32.3N 137.7E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR EYE CLEAR EYE DIA 50 KM
46	211700Z	32.6N 137.7E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR
47	211800Z	32.5N 137.8E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR
48	211900Z	32.6N 137.8E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR
49	212000Z	32.8N 137.7E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN. SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
50	212100Z	33.0N 137.7E	LND RDR	--	--	--	--	---	--/--	MT FUJI RDR 60 KM X 40 KM NNE-SSW
51	212200Z	33.1N 137.7E	LND RDR	--	--	--	--	---	--/--	MT FUJI RDR EYE CLEAR
52	212235Z	33.2N 137.6E	54-R-P3	18,000 ft	--	--	--	---	--/--	EYE 35 MI DIA
53	212300Z	33.3N 137.7E	LND RDR	--	--	--	--	---	--/--	MT FUJI RDR EYE CLR & CIRC
54	212330Z	33.3N 137.5E	54-P-P2	700mb	--	--	965	2777	16/--	EYE CIRC 25 MI DIA
55	220000Z	33.4N 137.7E	LND RDR	--	--	--	--	---	--/--	MT FUJI RDR EYE CLEAR
56	220100Z	33.5N 137.7E	LND RDR	--	--	--	--	---	--/--	EYE CLEAR
57	220137Z	33.5N 137.5E	TIROS	--	--	--	--	---	--/--	STAGE X DIA 5 BNDS 4 EYE VSBL
58	220200Z	33.6N 137.7E	LND RDR	--	--	--	--	---	--/--	MT FUJI RDR EYE CLEAR
59	220300Z	33.8N 137.7E	54-P-P2	700mb	--	--	968	2789	17/--	EYE CIRC 30 MI DIA
60	220300Z	33.7N 137.9E	LND RDR	--	--	--	--	---	--/--	MT FUJI RDR EYE CLEAR
61	220400Z	33.9N 137.8E	54-P-2	700mb	--	--	979	2792	16/--	EYE CIRC 30 MI DIA
62	220400Z	33.8N 138.0E	LND RDR	--	--	--	--	---	--/--	CLR EYE
63	220500Z	34.1N 137.9E	54-P-P2	700mb	--	--	987	2798	16/--	EYE CIRC 30 MI DIA
64	220500Z	33.9N 138.2E	LND RDR	--	--	--	--	---	--/--	MT FUJI RDR CLR EYE
65	220600Z	34.1N 138.2E	LND RDR	--	--	--	--	---	--/--	MT FUJI RDR CLR EYE



FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
66	220700Z	34.3N 138.3E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR CLR EYE
67	220800Z	34.4N 138.4E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR CLR EYE
68	220900Z	34.6N 138.3E	VW1-R-P5	700mb	--	50	--	----	--/--	EYE CIRC 30 MI DIA
69	221015Z	34.7N 138.7E	VW1-R-U	700mb	--	--	--	----	--/--	
70	221100Z	34.8N 138.8E	LND RDR	--	--	--	--	----	--/--	SML BUT CLR EYE
71	221200Z	34.9N 138.9E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR
72	221300Z	35.2N 139.1E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR CLSD EYE
73	221400Z	35.4N 139.2E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR CLSD EYE
74	221500Z	35.4N 139.1E	LND RDR	--	--	--	--	----	--/--	MT FUJI RDR
75	230320Z	36.7N 141.6E	54-P-P2	500mb	--	--	--	----	0/--	

TYPHOON LUCY 15 AUG-23 AUG 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
150600Z	15.0N	170.3E	-----	-----
151200Z	15.6N	169.5E	-----	-----
151800Z	16.3N	168.4E	-----	-----
160000Z	17.1N	167.0E	-----	-----
160600Z	18.1N	165.0E	089-196	-----
161200Z	19.2N	162.9E	096-295	-----
161800Z	20.2N	161.3E	098-350	-----
170000Z	21.3N	159.6E	115-216	-----
170600Z	22.5N	157.7E	130-156	103-496
171200Z	23.6N	154.5E	262-154	106-587
171800Z	24.4N	153.4E	174-092	104-674
180000Z	25.2N	151.3E	167-090	120-442
180600Z	25.6N	149.3E	104-032	123-299
181200Z	26.3N	147.4E	012-050	273-130
181800Z	26.8N	145.6E	325-070	149-95
190000Z	26.7N	144.1E	312-042	122-98
190600Z	27.0N	142.7E	100-222	326-99
191200Z	27.4N	141.7E	292-170	298-172
191800Z	27.8N	140.7E	288-225	287-275
200000Z	28.5N	140.2E	281-240	273-287
200600Z	29.2N	139.7E	249-221	147-80
201200Z	30.1N	139.4E	228-182	277-486
201800Z	31.0N	139.2E	230-230	278-565
210000Z	31.1N	138.1E	242-106	277-500
210600Z	31.4N	137.5E	284-80	260-405
211200Z	31.9N	137.6E	273-106	243-338
211800Z	32.6N	137.8E	354-234	245-409
220000Z	33.4N	137.6E	310-212	261-332
220600Z	34.1N	138.0E	308-205	287-226
221200Z	34.9N	138.9E	260-245	278-244
221800Z	35.8N	139.7E	335-165	042-502
230000Z	36.3N	140.9E	275-242	009-230
230600Z	37.2N	142.1E	318-064	025-250

AVERAGE 24 HOUR ERROR 169 MI

AVERAGE 48 HOUR ERROR 329 MI

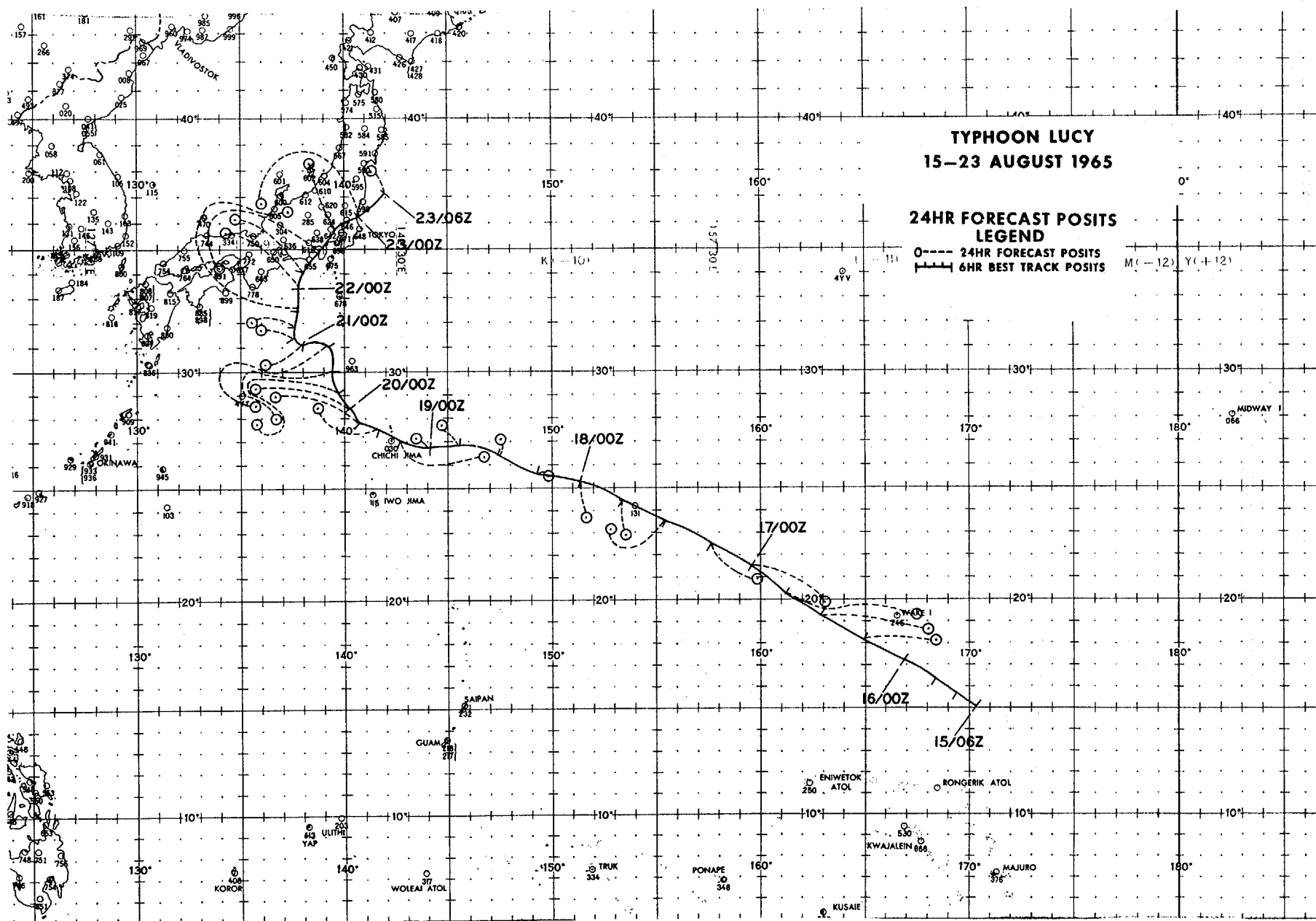
# **TYPHOON LUCY** **15-23 AUGUST 1965**

## **24HR FORECAST POSITS** **LEGEND**

0--- 24HR FORECAST POSITS  
 --- 6HR BEST TRACK POSITS

M(-12) Y(+12)

167



TYPHOON MARY - 150600Z TO 191200Z AUGUST

I. DATA

A. Statistics

1. Number of warnings issued - 18
2. Number of warnings with typhoon intensity - 14
3. Total distance traveled during tropical warning period - 1000 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 936mbs at 170310Z
2. Minimum observed 700mb height - 2560m. at 170310Z
3. Maximum surface wind - 150 kts (From Best Track)
4. Maximum radius of surface circulation - 600 mi

II. DEVELOPMENT

A. Initial impetus - Juxtaposition of Polar trough and easterly wave and subsequent fracture.

B. Initial surface vortex

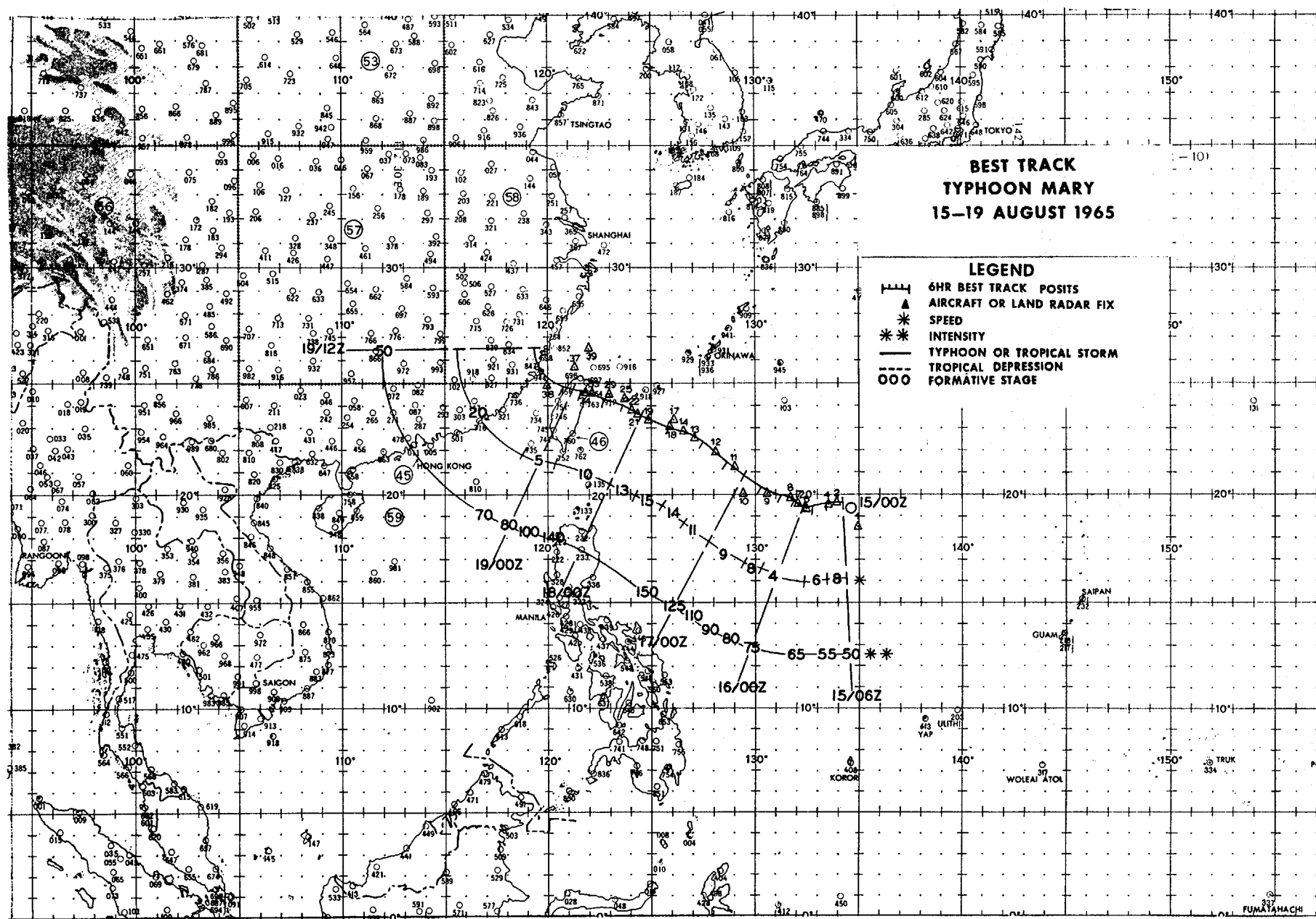
1. Embedded vortex at 150000Z
2. Surface pressure less than 1006mbs

C. 200mb flow above surface vortex

1. Initial - northeast
2. Upon reaching typhoon intensity - near center of anticyclone

III. FINAL DISPOSITION

A. Dissipated over land



## EYE FIXES TYPHOON MARY

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	150142Z	18.5N 135.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 3.5, BNDS 3 WELL DEVELOPED BNDG TO S
2	150745Z	19.6N 134.0E	VW1-P-P5	955mb	50	50	980	---	27/20	EYE CIRC 34 MI DIA SYSTEM HAS CLASSIC PRESENTATION
3	150845Z	19.6N 133.8E	VW1-R-P10	955mb	50	50	--	---	--/--	EYE CIRC 26 MI DIA EYE TIGHTENING
4	151000Z	19.5N 133.6E	VW1-R-10	1500ft	--	--	--	---	--/--	
5	151045Z	19.5N 133.5E	VW1-R-10	1500ft	--	--	--	---	--/--	
6	152255Z	19.3N 132.4E	54-P-P4	700mb	62	75	982	2920	18/--	EYE CIRC 15 MI DIA
7	160300Z	19.5N 132.1E	54-P-P4	700mb	65	80	965	2883	15/07	EYE CIRC 15 MI DIA
8	160845Z	19.8N 131.7E	VW1-P-P10	700mb	--	80	968	---	16/10	EYE CIRC 25 MI DIA CLASSIC FDR BNDS ALL QUADS
9	161445Z	20.0N 130.6E	VW1-R-P10	700mb	--	--	--	---	--/--	EYE CIRC 20 MI DIA FDR BNDS 250 MI NE-E-S STM APPEARS SLIGHTLY WKR
10	170223Z	20.0N 129.5E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 4, BNDS 4 EYE VSBL EST POSIT
11	170310Z	21.2N 129.0E	56-P-P2	700mb	120	150	936	2560	19/07	EYE CIRC 20 MI DIA RDR CNTR 360 DEG 05 MI FM SFC CNTR
12	170843Z	21.9N 128.1E	VW1-R-P2	900ft	--	90	--	---	--/--	EYE CIRC 10 MI DIA FDR BNDS ALL QUADS

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
13	171300Z	22.4N 127.1E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
14	171445Z	22.8N 126.6E	VW1-R-P10	1300ft	65	65+	--	---	--/--	EYE CIRC 20 MI DIA STG FDR BNDS ALL QUADS
15	171500Z	22.6N 126.6E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
16	171600Z	22.8N 126.4E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
17	171800Z	23.3N 126.1E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
18	171800Z	23.0N 125.9E	LND RDR	--	--	--	--	---	--/--	NAHA RDR
19	172000Z	23.3N 124.9E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
171 20	180000Z	23.5N 124.8E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
21	180050Z	23.5N 124.5E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
22	180235Z	23.7N 124.2E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
23	180355Z	23.8N 124.1E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
24	180500Z	23.9N 124.1E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
25	180800Z	24.2N 123.7E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
26	180856Z	24.2N 123.6E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
27	180958Z	24.2N 123.5E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
28	181015Z	24.5N 123.0E	LND RDR	--	--	--	--	---	--/--	BIG LAKE RDR
29	181100Z	24.5N 123.0E	LND RDR	--	--	--	--	---	--/--	BIG LAKE RDR
30	181230Z	24.4N 122.8E	LND RDR	--	--	--	--	---	--/--	BIG LAKE RDR

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
31	181300Z	24.3N 122.8E	LND RDR	--	--	--	--	---	--/--	BIG LAKE RDR
32	181300Z	24.5N 122.9E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
33	181500Z	24.5N 122.2E	LND RDR	--	--	--	--	---	--/--	SHIHMEN RDR
34	181530Z	24.6N 121.9E	LND RDR	--	--	--	--	---	--/--	MIYAKO JIMA RDR
35	181550Z	24.6N 122.1E	54-R-P2	700mb	--	--	--	---	--/--	EYE CIRC 13 MI DIA
36	181600Z	24.5N 121.9E	LND RDR	--	--	--	--	---	--/--	SHIHMEN RDR
37	182100Z	25.7N 121.4E	54-R-P2	700mb	--	--	--	---	--/--	EYE OVAL 15 X 25 MI WALL CLDS WK ALL QUADS
38	182300Z	24.8N 120.0E	LND RDR	--	--	--	--	---	--/--	MAKUNG RDR
39	190354Z	26.5N 122.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 7, BNDS 3

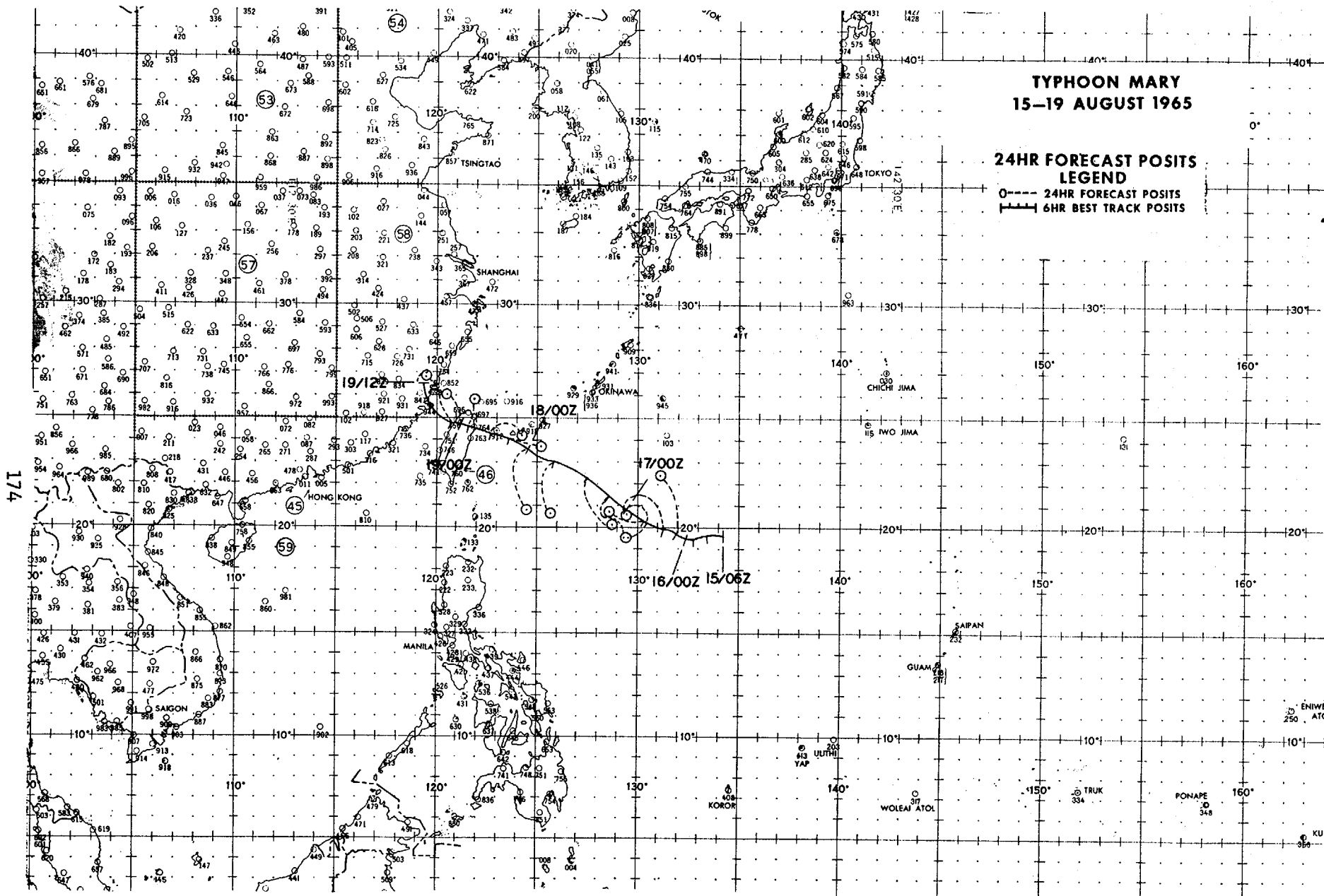


TYPHOON MARY 15 AUG-19 AUG 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
150600Z	19.5N	134.3E	-----	-----
151200Z	19.5N	133.4E	-----	-----
151800Z	19.3N	132.8E	-----	-----
160000Z	19.3N	132.3E	-----	-----
160600Z	19.7N	131.9E	347-167	-----
161200Z	19.9N	131.1E	291-98	-----
161800Z	20.3N	130.3E	288-100	-----
170000Z	20.8N	129.5E	172-77	-----
170600Z	21.4N	128.6E	162-125	328-145
171200Z	22.3N	127.4E	151-150	263-155
171800Z	23.0N	125.9E	186-142	255-122
180000Z	23.5N	124.6E	183-160	167-194
180600Z	24.0N	123.7E	104-80	174-194
181200Z	24.3N	122.7E	088-83	156-237
181800Z	24.6N	121.6E	011-77	197-163
190000Z	24.7N	121.2E	338-85	214-161
190600Z	24.8N	120.7E	332-132	045-83
191200Z	26.4N	119.3E	019-28	050-88

AVERAGE 24 HOUR ERROR 107 MI

AVERAGE 48 HOUR ERROR 154 MI



TYPHOON OLIVE - 280000Z AUGUST TO 020000Z SEPTEMBER

I. DATA

A. Statistics

1. Number of warnings issued - 21
2. Number of warnings with typhoon intensity - 17
3. Total distance traveled during tropical warning period - 1118 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 936mbs at 300300Z
2. Minimum observed 700mb height - 2582m. at 300300Z
3. Maximum surface wind - 150 kts (From Best Track)
4. Maximum radius of surface circulation - 550 mi

II. DEVELOPMENT

A. Initial impetus - Intensification by increased Southern Hemisphere indraft of mid level low that drifted northeastward from a position north of Koror.

B. Initial surface vortex

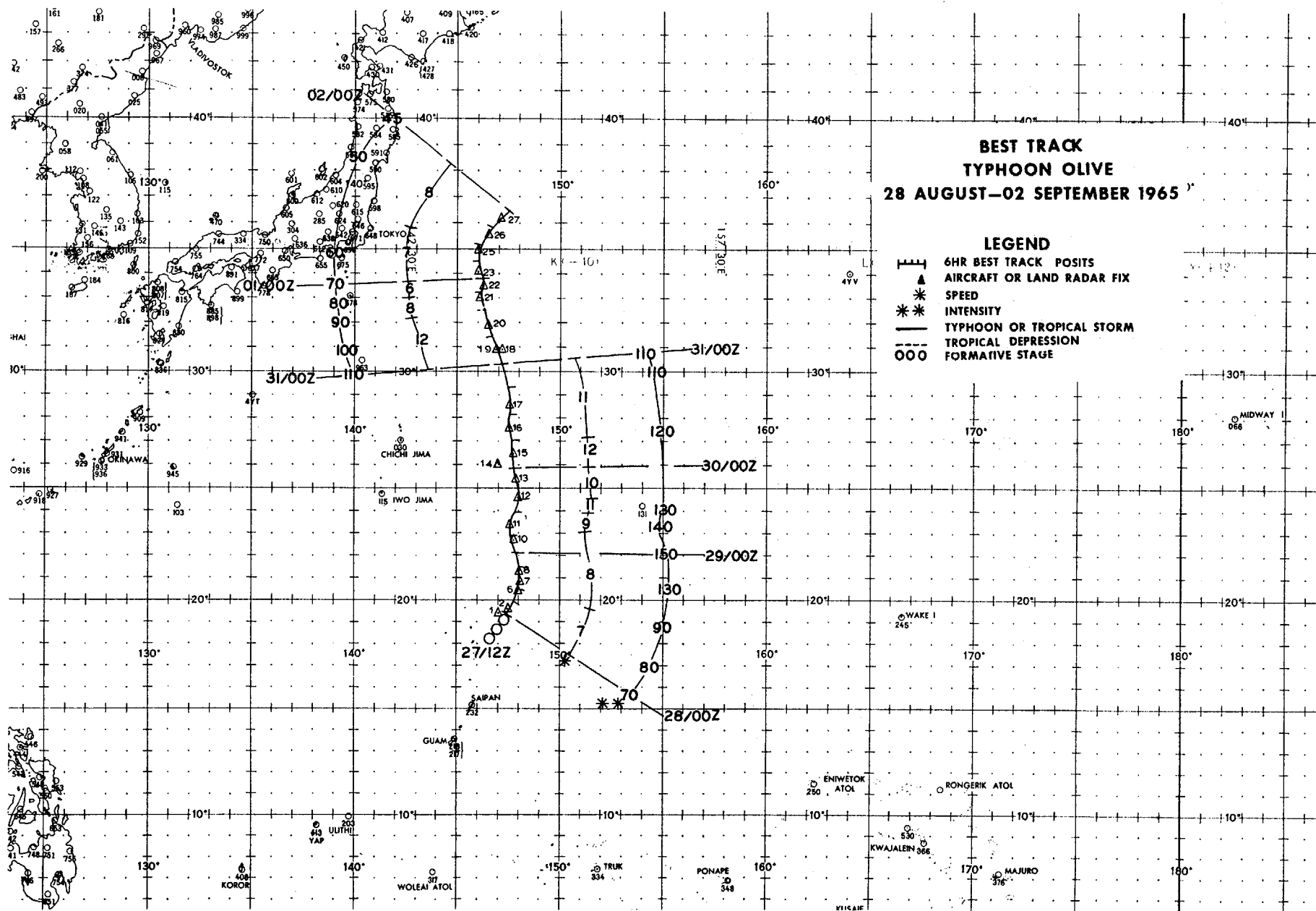
1. Junction vortex at 271200Z
2. Surface pressure less than 1003mbs

C. 200mb flow above surface vortex

1. Initial - northerly
2. Upon reaching typhoon intensity - northerly

III. FINAL DISPOSITION

A. Became extratropical



## EYE FIXES TYPHOON OLIVE

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	272330Z	19.3N 147.0E	VW1-R-P10	1500ft	--	--	---	---	--/--	EYE CIRC 10 MI DIA
2	280033Z	19.4N 147.5E	VW1-P-U	1500ft	--	75	975	---	--/--	
3	280131Z	19.6N 147.5E	VW1-P-U	1500ft	--	--	---	---	--/--	
4	280200Z	19.6N 147.6E	VW1-R-U	1500ft	--	--	---	---	--/--	EYE CLOSED
5	280245Z	19.6N 147.6E	VW1-R-P2	1500ft	--	40	---	---	--/--	EYE CIRC 4 MI DIA
6	280900Z	20.3N 148.0E	VW1-R-P2	1500ft	--	--	---	---	--/--	
7	281325Z	20.7N 148.1E	VW1-R-U	1500ft	--	--	---	---	--/--	
8	281615Z	21.2N 148.0E	VW1-R-P5	1500ft	--	--	---	---	--/--	EYE CIRC 5 MI DIA
9	282115Z	21.3N 148.3E	54-P-P3	700mb	90	120	963	2789	18/--	EYE CIRC 2 MI DIA
10	290300Z	22.6N 147.8E	54-R-P3	700mb	75	170	947	2719	21/--	EYE CIRC 8 MI DIA
11	290900Z	23.3N 147.6E	VW1-R-P15	427m	--	--	---	---	--/--	EYE CIRC 10 MI DIA
12	291445Z	24.5N 148.0E	VW1-R-P10	3277m	--	--	---	---	--/--	EYE CIRC 17 MI DIA
13	292100Z	25.3N 147.9E	54-P-PU	700mb	110	115	951	2679	24/--	EYE CIRC 11 MI DIA
14	292209Z	26.0N 147.0E	TIROS	--	--	--	---	---	--/--	STAGE X, DIA 5, BNDS 4
15	300300Z	26.4N 147.8E	54-P-P1	700mb	80	85	936	2582	20/--	
16	300900Z	27.5N 147.6E	VW1-R-P5	1500ft	--	--	---	---	--/--	EYE CIRC 12 MI DIA

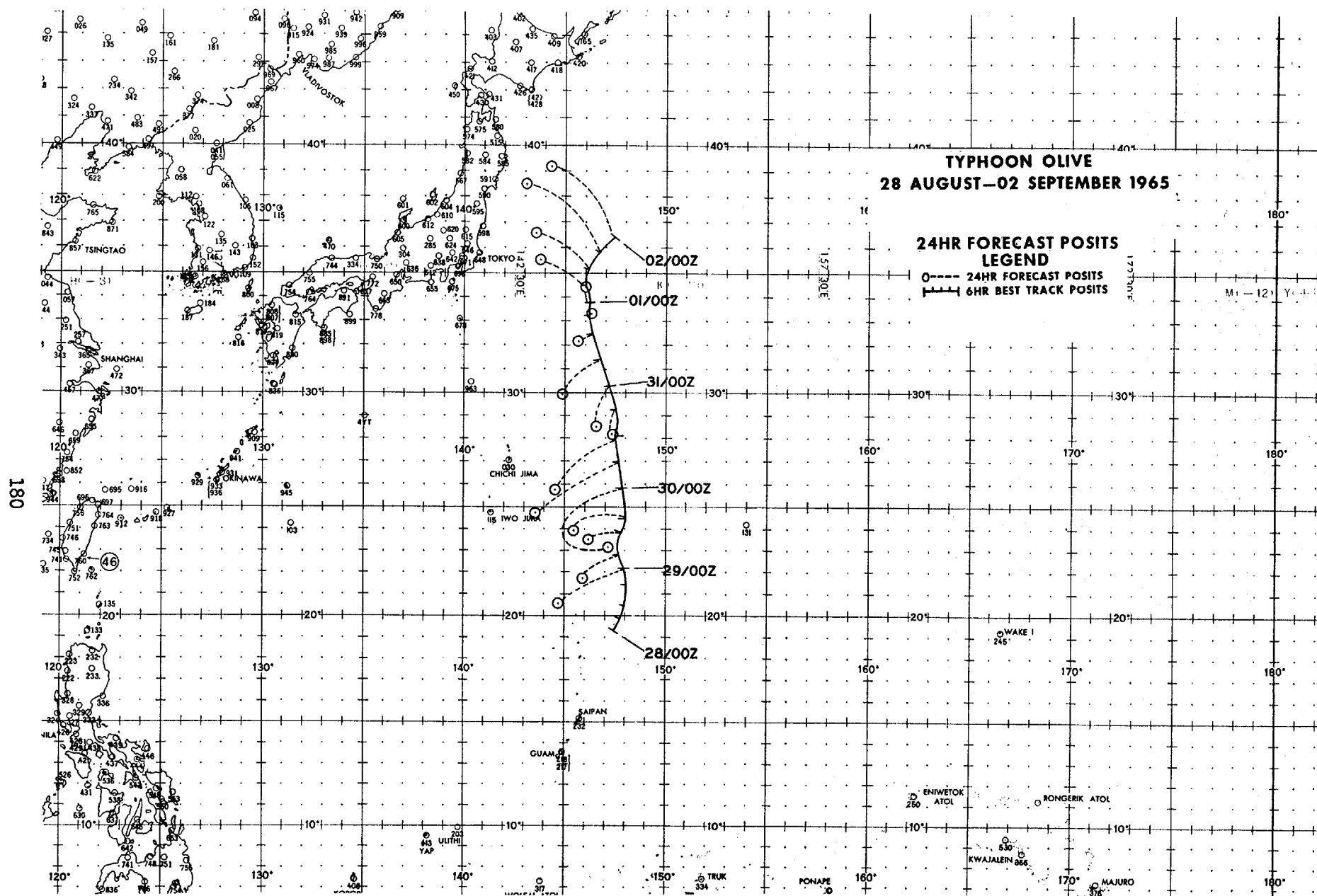
FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
17	301445Z	28.5N 147.6E	VW1-R-P10	700mb	--	--	---	---	--/--	EYE CIRC 14 MI DIA
18	310015Z	30.8N 147.2E	54-P-P5	700mb	90	100	953	2694	16/15	EYE CIRC 15 MI DIA
19	310300Z	30.8N 146.9E	54-P-P2	700mb	80	130	953	2694	19/19	EYE CIRC 18 MI DIA
20	310845Z	31.8N 146.5E	VW1-P-P5	1500ft	--	90	960.9	---	23/18	EYE CIRC 13 MI DIA
21	311445Z	33.0N 146.1E	VW1-R-P10	1500ft	70	--	---	---	--/--	EYE DSPTD CNTR 40 MI DIA
22	312050Z	33.4N 146.3E	54-P-P2	700mb	35	40	972	2832	14/12	700 MB CALM AND LOWEST PRES FIXED
23	312213Z	34.0N 146.0E	TIROS	--	--	--	---	---	--/--	STAGE X, BNDS 4, DIA 3
24	010245Z	34.1N 146.1E	54-P-P2	700mb	60	60	---	2844	15/13	700MB WND, TEMP, PRES CNTR FIXED. MANY VISUAL EYES N & E
25	010923Z	34.9N 146.0E	VW1-P-P5	1500ft	41	50	970	---	22/16	EYE FILLED WITH CLOUDS WK FDR BNDS. NEG TEMP RISE IN CNTR
26	011453Z	35.4N 146.5E	VW1-P-P10	700mb	--	--	---	2871	16/12	WK BUT WELL DEFINED FDR BNDS
27	012120Z	36.2N 147.1E	54-P-PU	700mb	39	35	---	2877	13/10	

TYPHOON OLIVE 28 AUG-02 SEPT 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
280000Z	19.3N	147.4E	-----	-----
280600Z	19.8N	147.8E	-----	-----
281200Z	20.5N	148.0E	-----	-----
281800Z	21.4N	148.1E	-----	-----
290000Z	22.2N	147.9E	242-204	-----
290600Z	22.9N	147.6E	233-122	-----
291200Z	23.8N	147.8E	253-92	-----
291800Z	24.5N	148.0E	248-153	-----
300000Z	25.8N	147.8E	192-168	230-364
300600Z	27.0N	147.7E	237-258	221-305
301200Z	28.1N	147.6E	228-217	238-318
301800Z	29.3N	147.4E	185-61	237-362
310000Z	30.3N	147.2E	198-112	205-376
310600Z	31.4N	146.7E	226-127	234-396
311200Z	32.5N	146.3E	236-35	217-405
311800Z	33.3N	146.2E	74-10	090-233
010000Z	33.8N	146.2E	179-36	213-213
010600Z	34.5N	146.0E	299-123	244-209
011200Z	35.2N	146.2E	304-153	337-126
011800Z	35.8N	146.7E	313-237	353-155
020000Z	36.4N	147.5E	317-232	352-227

AVERAGE 24 HOUR ERROR 138 MI

AVERAGE 48 HOUR ERROR 284 MI





TYPHOON ROSE - 010600Z TO 051800Z SEPTEMBER

I. DATA

A. Statistics

1. Number of warnings issued - 19
2. Number of warnings with typhoon intensity - 16
3. Total distance traveled during tropical warning period - 1232 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 968mbs at 041012Z
2. Minimum observed 700mb height - 2981m. at 020915Z
3. Maximum surface wind - 100 kts (From Best Track)
4. Maximum radius of surface circulation - 400 mi

II. DEVELOPMENT

A. Initial impetus - Divergent flow at 200mb over strong indraft in low level feeding Typhoon OLIVE to the northeast. Cyclonic turning developed in low level flow.

B. Initial surface vortex

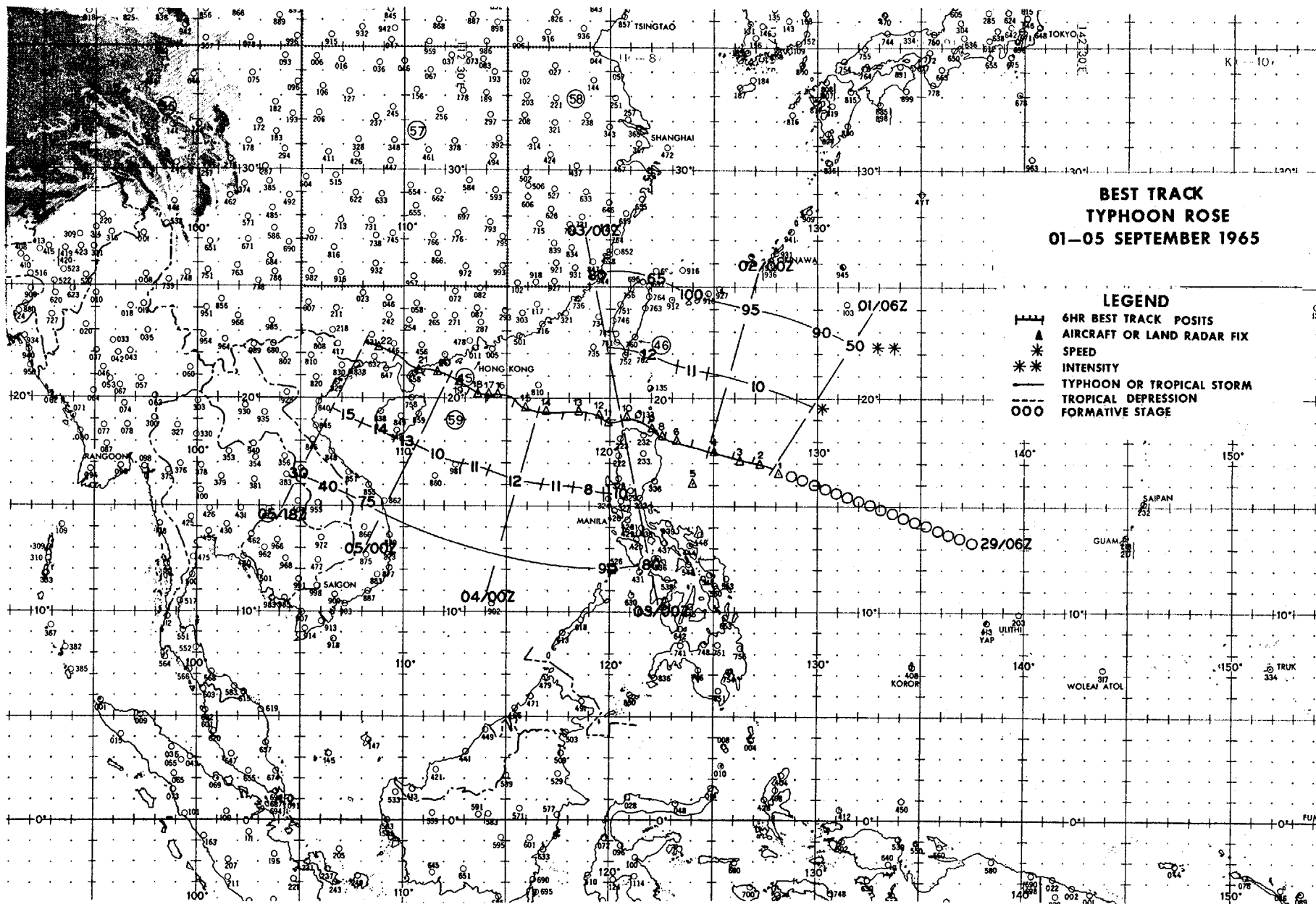
1. Junction vortex at 290600Z
2. Surface pressure less than 1004mbs

C. 200mb flow above surface vortex

1. Initial - northeasterly
2. Upon reaching typhoon intensity - north-northeasterly

III. FINAL DISPOSITION

A. Dissipated over land



## EYE FIXES TYPHOON ROSE

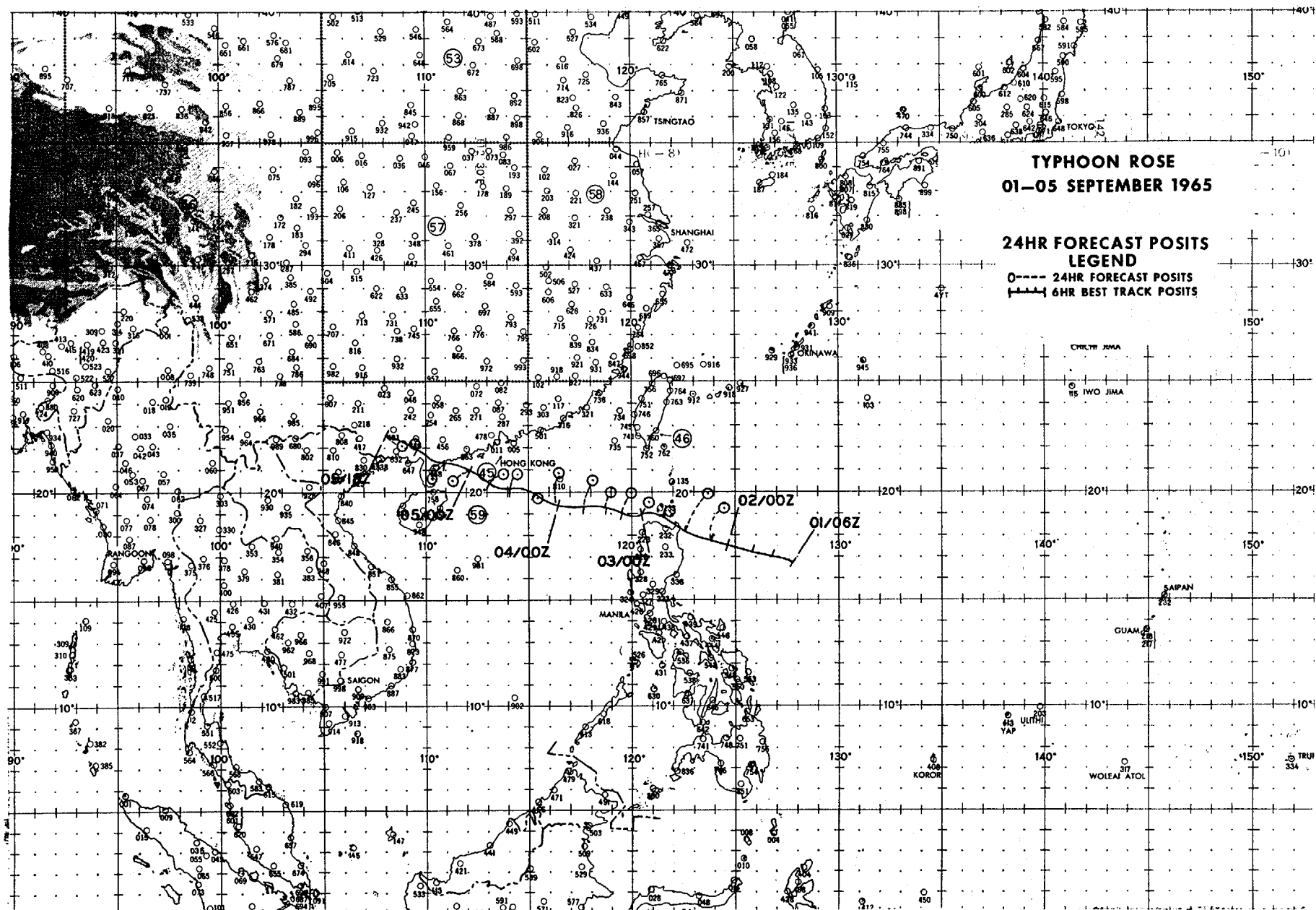
FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	010350Z	16.5N 128.1E	54-P-P3	1500ft	40	50	990	---	24/--	EYE CIRC 20 MI DIA. FDR BNDS ALL QUADS
2	010912Z	16.9N 127.2E	VW1-P-P5	1500ft	80	90	986	---	26/23	EYE CIRC 30 MI DIA. EYE OPEN NE SEMI
3	011445Z	17.1N 126.2E	VW1-R-P10	700mb	45	--	---	---	--/--	CNTR CIRC 30 MI DIA. CNTR A VORTEX IN E SIDE MASS HVY WX
4	012258Z	17.5N 125.0E	TIROS	--	--	--	---	---	--/--	CNTR OF BRIGHT CI AREA
5	020244Z	16.0N 124.0E	TIROS	--	--	--	---	---	--/--	STAGE D, BNDS 1, DIA 5
6	020915Z	18.0N 123.2E	56-P-P3	700mb	80	100	984	2981	14/10	EYE CIRC 20 MI DIA
7	020945Z	17.9N 123.1E	56-P-P3	700mb	80	100	---	---	--/--	EYE CIRC 20 MI DIA
8	021442Z	18.2N 122.4E	VW1-R-10	700mb	--	--	---	---	--/--	
9	021621Z	18.6N 122.0E	VW1-R-F2	760mb	30	--	---	---	--/--	
10	022200Z	19.1N 120.8E	56-P-P1	700mb	25	40	993	3030	13/09	EYE CIRC 15 MI DIA
11	030300Z	18.8N 119.9E	56-P-P1	700mb	35	90	989	3018	14/08	RDR EYE CIRC 18 MI DIA
12	030800Z	19.2N 119.4E	56-P-P1	700mb	35	65	988	2999	15/10	RDR EYE CIRC 24 MI DIA SFC CALM 3 MI DIA
13	031445Z	19.3N 118.4E	VW1-R-P10	700mb	--	--	---	---	--/--	EYE CIRC 9 MI DIA. HVY FDR BNDS
14	032100Z	19.3N 116.9E	VW1-R-P5	700mb	--	--	---	---	--/--	EYE CIRC 9 MI DIA. STM GREATLY INTENSIFIED

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
15	040245Z	19.6N 115.9E	VW1-P-P10	1500ft	--	80	977	---	25/20	EYE CIRC 10 MI DIA
16	041012Z	20.2N 114.5E	VW1-P-P10	938mb	--	90	968	---	27/25	EYE CIRC 18 MI DIA
17	041235Z	20.2N 114.1E	VW1-P-PU	1500ft	--	--	---	---	--/--	THIS RDR POSIT. WND EYE 10 MI N
18	041459Z	20.2N 113.6E	VW1-P-P5	723mb	65	--	---	---	24/--	EYE CIRC 18 MI DIA
19	042100Z	20.7N 112.6E	VW1-R-P5	335m	--	--	---	---	26/24	EYE CIRC 7 MI DIA
20	050255Z	21.1N 111.7E	VW1-R-P10	335m	52	--	---	---	--/--	EYE CIRC 13 MI DIA
21	050700Z	21.3N 110.7E	VW1-R-U	700mb	--	--	---	---	--/--	ROSE ASHORE
22	051515Z	22.3N 108.7E	VW1-R-U	--	--	--	---	---	--/--	CNTR BADLY DISORGANIZED. 3 POORLY DEFINED FDR BNDS
23	052120Z	-- --	VW1-R-U	--	--	--	---	---	--/--	ROSE DSPTD IN MOUNTAINS NW GULF OF TONKIN. NEG BNDS. NEG CNTR

TYPHOON ROSE 01 SEPT-05 SEPT 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
010600Z	15.7N	127.7E	-----	-----
011200Z	16.2N	126.8E	-----	-----
011800Z	16.6N	125.9E	-----	-----
020000Z	17.2N	124.9E	-----	-----
020600Z	17.7N	123.9E	019-98	-----
021200Z	18.1N	122.6E	027-123	-----
021800Z	18.7N	121.6E	023-20	-----
030000Z	18.9N	120.5E	034-42	-----
030600Z	19.0N	119.6E	026-54	030-185
031200Z	19.4N	118.8E	014-39	025-200
031800Z	19.3N	117.7E	019-75	017-106
040000Z	19.3N	116.5E	357-90	020-144
040600Z	19.9N	115.3E	130-08	024-155
041200Z	20.2N	114.2E	038-38	030-150
041800Z	20.4N	113.2E	059-44	029-169
050000Z	20.9N	112.2E	245-62	006-84
050600Z	21.3N	111.0E	223-59	138-45
051200Z	21.8N	109.6E	340-23	087-59
051800Z	22.5N	108.1N	118-51	113-100

AVERAGE 24 HOUR ERROR 55 MI  
AVERAGE 48 HOUR ERROR 127 MI



TYPHOON SHIRLEY - 040000Z TO 101800Z SEPTEMBER

I. DATA

A. Statistics

1. Number of warnings issued - 28
2. Number of warnings with typhoon intensity - 19
3. Total distance traveled during tropical warning period - 2255 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 936mbs at 082100Z and 092110Z
2. Minimum observed 700mb height - 2542m. at 082100Z
3. Maximum surface wind - 130 kts (From Best Track)
4. Maximum radius of surface circulation - 625 mi

II. DEVELOPMENT

A. Initial impetus - Divergence aloft and surge of low and mid level inflow from Southern Hemisphere

B. Initial surface vortex

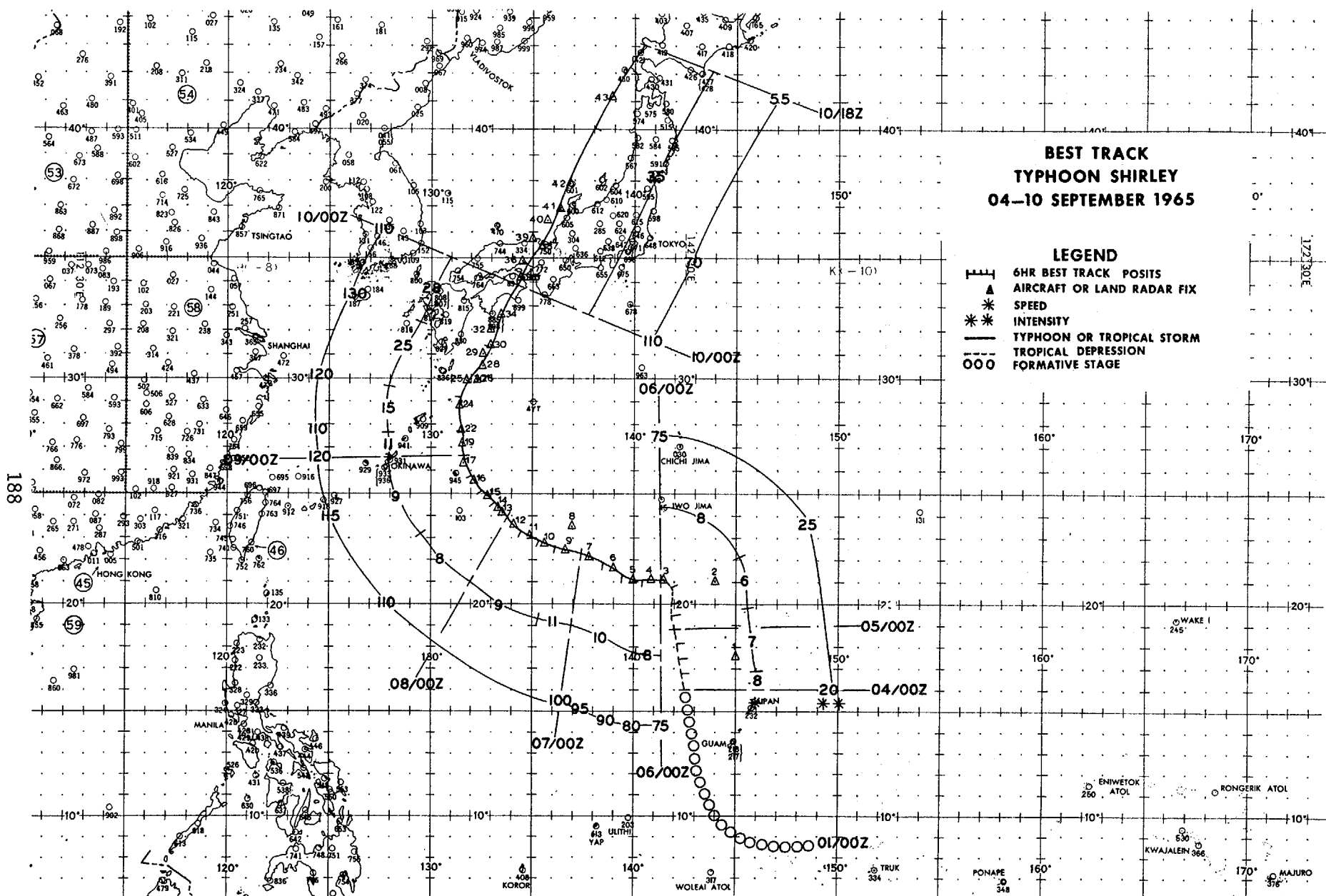
1. Junction vortex at 010000Z
2. Surface pressure less than 1007mbs

C. 200mb flow above surface vortex

1. Initial - northeasterly divergent flow
2. Upon reaching typhoon intensity - southerly flow

III. FINAL DISPOSITION

A. Became extratropical





## EYE FIXES TYPHOON SHIRLEY

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	040146Z	17.5N 145.0E	TIROS X	--	--	--	--	---	--/--	
2	050115Z	21.0N 144.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 4, BNDS 2 MOD TO STG EXTERNAL BNDG TO NW
3	052200Z	21.1N 141.5E	VW1-P-P10	305M	--	80	981	---	28/24	EYE CIRC 25 MI DIA
4	060245Z	21.2N 140.8E	VW1-R-P15	957mb	--	45	--	---	--/--	EYE CIRC 30 MI DIA
5	060900Z	21.1N 140.0E	54-P-P5	700mb	60	85	978	2920	20/--	EYE CIRC 18 MI DIA
6	061445Z	21.6N 139.0E	VW1-P-P5	723mb	50	60	--	2811	18/15	EYE ELIP 25 X 18 E-W
7	062100Z	22.1N 137.8E	56-P-P10	700mb	75	100	970	---	17/15	EYE CIRC 20 MI DIA
8	070156Z	23.5N 137.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 4, BNDS 3
9	070330Z	22.4N 136.6E	54-P-P3	700mb	60	100	960	2786	18/--	OVAL 10 X 20
10	071000Z	22.7N 135.6E	VW1-R-P5	320M	--	--	--	---	--/--	EYE CIRC 25 MI DIA
11	071500Z	23.1N 134.9E	VW1-P-P5	694mb	--	--	--	2786	16/13	EYE ELIP 25 X 20 NNE-SSW
12	072100Z	23.6N 134.1E	54-P-P5	700mb	--	100	951	2694	17/--	EYE CIRC 10 MI DIA
13	080120Z	24.1N 133.6E	54-P-U	700mb	--	--	--	2694	--/--	
14	080300Z	24.3N 133.4E	54-P-P5	700mb	80	130	949	2691	17/--	EYE CIRC 10 MI DIA
15	080856Z	24.8N 132.8E	VW1-R-P4	305M	60	80	--	---	--/--	EYE CIRC 8 MI DIA
16	081445Z	25.5N 132.2E	VW1-R-P5	1450ft	--	--	--	---	--/--	EYE CIRC 9 MI DIA

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
17	082100Z	26.3N 131.7E	56-P-P3	700mb	85	120	936	2542	17/13	EYE CIRC 15 MI DIA NO SFC CALM EYE VERTICAL
18	090000Z	26.2N 131.5E	LND RDR	--	--	--	--	---	--/--	STA 47909
19	090200Z	27.2N 131.6E	56-P-P2	700mb	75	100	944	2612	19/14	EYE CIRC 25 MI DIA NO RDR EYE STM APPRS TO BE BRKG UP
20	090300Z	27.2N 131.6E	LND RDR	--	--	--	--	---	--/--	STA 47909
21	090445Z	27.6N 131.5E	LND RDR	--	--	--	--	---	--/--	AMAMI SHIMA
22	090600Z	27.7N 131.6E	LND RDR	--	--	--	--	---	--/--	STA 47909
23	090900Z	28.7N 131.6E	LND RDR	--	--	--	--	---	--/--	STA 47909
24	090915Z	28.8N 131.4E	VW1-R-F5	850mb	--	75	--	---	--/--	EYE CIRC 10 MI DIA
25	091200Z	29.9N 131.8E	LND RDR	--	--	--	--	---	--/--	STA 47909
26	091400Z	29.9N 132.2E	LND RDR	--	--	--	--	---	--/--	STA 47808
27	091450Z	30.2N 132.3E	LND RDR	--	--	--	--	---	--/--	STA 47808
28	091554Z	30.5N 132.6E	VW1-R-P5	700mb	--	--	--	---	--/--	EYE CIRC 25 MI DIA WND EYE BY HOLE IN SEA RETURN CON- FIRMS RDR EYE
29	091600Z	31.0N 132.7E	LND RDR	--	--	--	--	---	--/--	KUSUGA
30	091800Z	31.3N 133.0E	LND RDR	--	--	--	--	---	--/--	STA 47869
31	091900Z	32.1N 133.3E	LND RDR	--	--	--	--	---	--/--	STA 47869
32	092000Z	32.0N 133.0E	LND RDR	--	--	--	--	---	--/--	KUSUGA

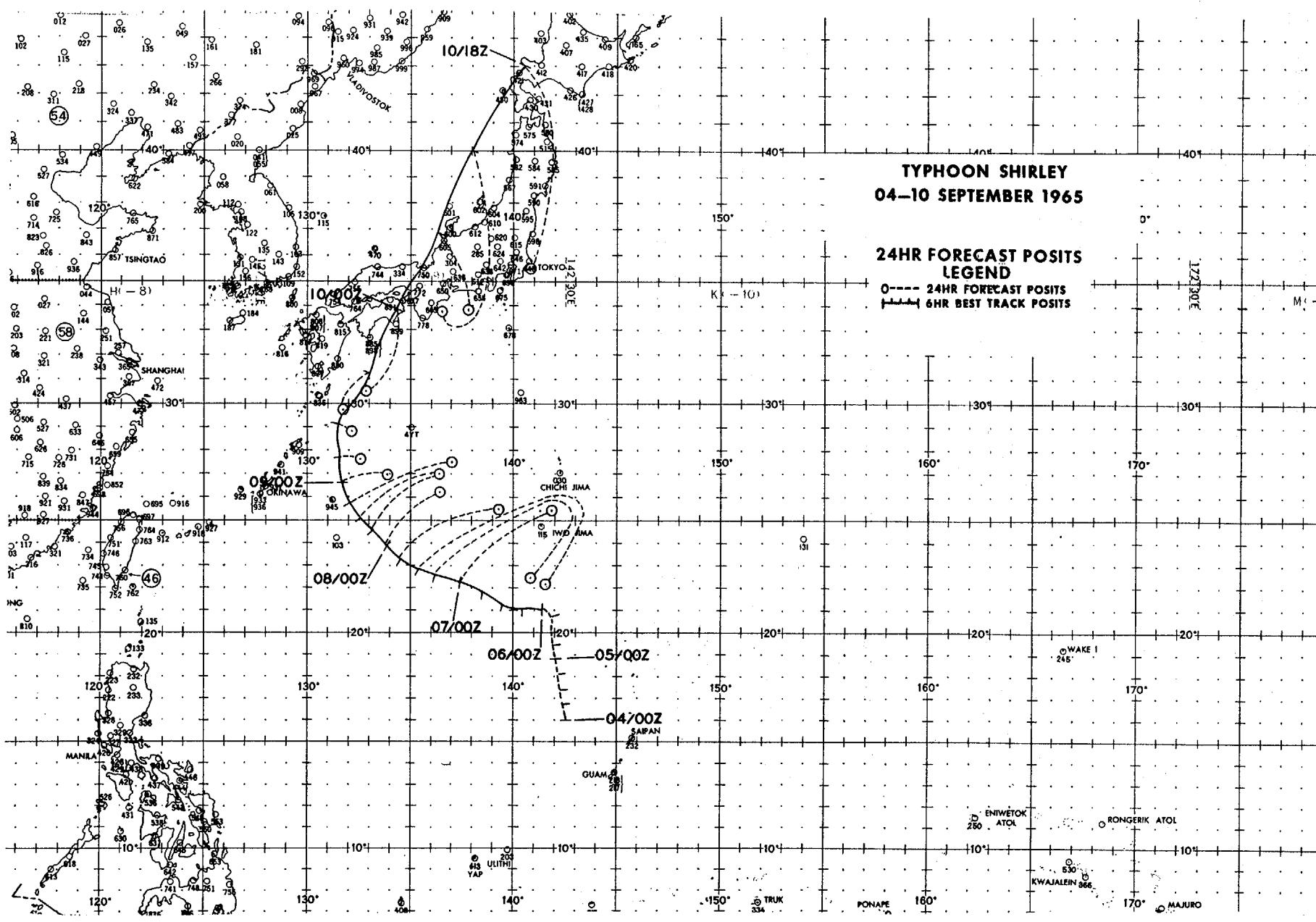
FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
33	092100Z	32.4N 133.3E	LND RDR	--	--	--	--	----	--/--	KUSUGA
34	092110Z	32.6N 133.4E	54-P-P5	700mb	110	150	936	2557	18/--	EYE CIRC 50 MI DIA RDR EYE 160/10 FM FIX NO SFC CALM
35	100030Z	34.2N 134.4E	54-U-U	--	--	--	--	----	--/--	
36	100200Z	34.8N 134.5E	54-R-U5	500mb	--	--	--	----	--/--	
37	100250Z	35.5N 135.5E	54-P-L15	500mb	80	100	--	----	08/--	500MB HT 5550M CIRC BRKG UP RAPIDLY LAST 4 HRS
38	100300Z	35.4N 135.4E	LND RDR	--	--	--	--	----	--/--	FUJI RDR
39	100300Z	35.7N 135.0E	LND RDR	--	--	--	--	----	--/--	STA 47636
40	100400Z	36.4N 135.7E	LND RDR	--	--	--	--	----	--/--	STA 47636
41	100500Z	36.9N 136.3E	LND RDR	--	--	--	--	----	--/--	STA 47636
42	100900Z	37.9N 136.8E	VW1-P-P2	700mb	--	75	--	2847	18/11	EYE CIRC 20 MI DIA WND EYE 5 MI DIA SAME POSIT
43	101500Z	41.2N 138.9E	VW1-P-F2	700mb	--	60	--	2862	15/11	PRES POS, RDR POOR SFC WND OBSERVED BY MOON

TYPHOON SHIRLEY 04 SEPT-10 SEPT 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
040000Z	16.0N	142.5E	-----	-----
040600Z	16.7N	142.4E	-----	-----
041200Z	17.4N	142.3E	-----	-----
041800Z	18.2N	142.2E	-----	-----
050000Z	18.8N	142.1E	-----	-----
050600Z	19.5N	142.0E	-----	-----
051200Z	20.1N	141.9E	-----	-----
051800Z	20.7N	141.9E	-----	-----
060000Z	21.2N	141.3E	-----	-----
060600Z	21.1N	140.4E	-----	-----
061200Z	21.3N	139.4E	-----	-----
061800Z	21.8N	138.5E	-----	-----
070000Z	22.3N	137.5E	052-310	-----
070600Z	22.5N	136.2E	090-252	-----
071200Z	22.8N	135.3E	096-343	-----
071800Z	23.3N	134.5E	065-295	-----
080000Z	23.9N	133.8E	045-195	065-720
080600Z	24.6N	133.2E	049-227	082-483
081200Z	25.1N	132.6E	060-232	085-510
081800Z	25.7N	132.0E	068-291	074-654
090000Z	26.6N	131.6E	082-125	069-630
090600Z	27.7N	131.5E	092-50	068-848
091200Z	29.2N	131.5E	127-41	073-814
091800Z	31.3N	132.9E	218-110	080-743
100000Z	33.8N	134.3E	200-208	112-383
100600Z	36.9N	136.3E	159-194	175-325
101200Z	40.1N	138.1E	192-376	178-428
101800Z	43.1N	140.4E	178-454	187-530

AVERAGE 24 HOUR ERROR 231 MI

AVERAGE 48 HOUR ERROR 589 MI



TYPHOON TRIX - 101200Z TO 181200Z SEPTEMBER

I. DATA

A. Statistics

1. Number of warnings issued - 33
2. Number of warnings with typhoon intensity - 27
3. Total distance traveled during tropical warning period - 2497 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 930mbs at 150200Z
2. Minimum observed 700mb height - 2508m. at 142100Z
3. Maximum surface wind - 130 kts (From Best Track)
4. Maximum radius of surface circulation - 850 mi

II. DEVELOPMENT

A. Initial impetus - Divergence aloft and surge of low and mid level inflow from Southern Hemisphere

B. Initial surface vortex

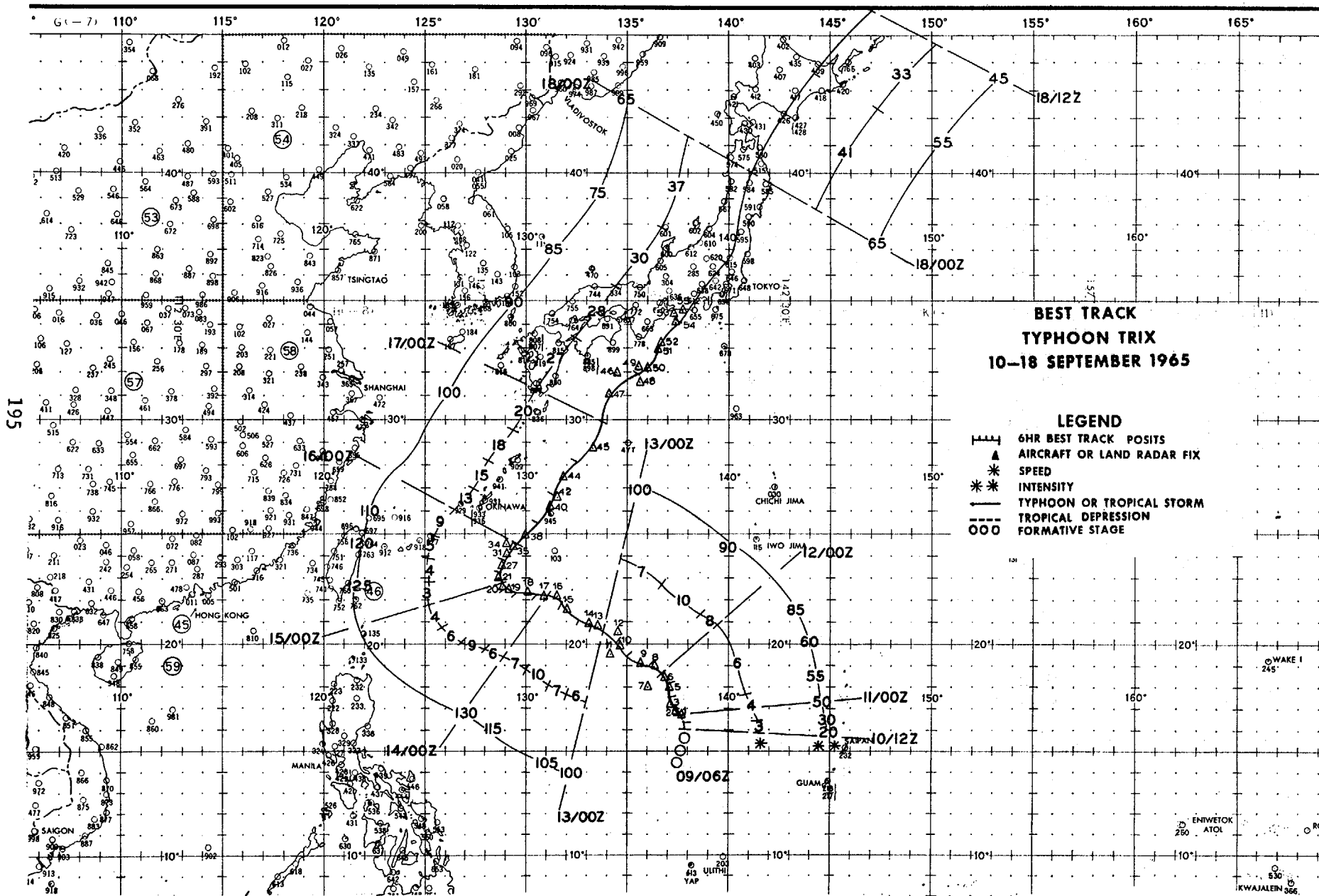
1. Junction vortex at 090600Z
2. Surface pressure less than 1005mbs

C. 200mb flow above surface vortex

1. Initial - northerly
2. Upon reaching typhoon intensity - near center of anticyclonic outdraft

III. FINAL DISPOSITION

A. Became extratropical



## EYE FIXES TYPHOON TRIX

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	102230Z	16.7N 137.7E	54-P-P3	700mb	--	45	986	2978	10/--	CNTR APPRS COLDER THAN ENVIRONMENT
2	110300Z	16.8N 137.3E	54-P-P5	700mb	42	55	980	2957	17/--	EYE CIRC 15 MI DIA WELL DEFINED
3	110900Z	17.2N 137.1E	VW1-P-P5	944mb	35	40	974	---	26/19	EYE CIRC 18 MI DIA CLASSIC FDR BNDS DVLPG
4	111240Z	17.3N 137.2E	VW1-R-U	700mb	--	--	--	---	--/--	
5	111440Z	17.9N 137.1E	VW1-P-P5	723mb	--	55	--	2954	15/09	EYE CIRC 20 MI DIA FDR BNDS TO 300 MI SW QUAD
6	1 250Z	18.4N 136.8E	54-P-P1	700mb	--	85	960	2859	16/--	EYE CIRC 20 MI DIA CLASSIC FDR BNDS ALL QUADS
7	120035Z	18.0N 136.0E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 7, BNDS 3
8	120330Z	19.0N 136.3E	54-P-P1	700mb	--	85	944	2844	17/--	EYE CIRC 20 MI DIA
9	120900Z	19.1N 135.6E	VW1-R-P5	1000 ft	--	60	--	---	--/--	EYE CIRC 10 MI DIA TOPS ABOVE 40,000 FT
10	121445Z	19.9N 134.6E	VW1-R-P5	1200 ft	--	--	--	---	--/--	EYE CIRC 5 MI DIA
11	122100Z	19.6N 134.1E	54-P-P3	700mb	35	65	969	2844	15/--	
12	130058Z	20.5N 134.5E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 5, BNDS 3



FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
13	130300Z	20.8N 133.5E	54-P-P3	700mb	55	70	959	2752	17/--	EYE CIRC 5 MI DIA STM WKR THAN AT LAST FIX
14	130844Z	20.9N 133.1E	VW1-R-P5	870 ft	--	75	--	---	--/--	EYE CIRC 8 MI DIA CON- CENTRIC OUTER EYE 65 MI DIA
15	131445Z	21.5N 132.0E	VW1-R-P10	1450 ft	55	--	--	---	--/--	EYE CIRC 10 MI DIA CON- CENTRIC OUTER EYE 50 MI DIA
16	132100Z	22.2N 131.5E	54-P-P2	700mb	--	40	945	2634	21/--	EYE CIRC 50 MI DIA
17	140200Z	22.2N 130.9E	54-P-P2	700mb	95	130	950	2670	20/--	RDR EYE CIRC 50 MI DIA WND EYE 20 MI DIA
18	140845Z	22.3N 130.1E	VW1-R-P10	955ft	80	95	--	---	--/--	RDR EYE CIRC 50 MI DIA
19	141445Z	22.4N 129.1E	VW1-R-P10	4190ft	--	--	--	---	--/--	EYE CIRC 50 MI DIA
20	142100Z	22.6N 128.8E	54-P-P3	700mb	100	80	933	2508	21/--	EYE CIRC 60 MI DIA FDR BNDS ALL QUADS
21	150200Z	23.0N 128.7E	54-P-P3	700mb	100	130	930	2508	20/--	EYE CIRC 60 MI DIA WALL CLD ALL QUAD 10 MI THICK
22	150430Z	23.1N 128.5E	LND RDR	--	--	--	--	---	--/--	
23	150800Z	23.1N 128.5E	LND RDR	--	--	--	--	---	--/--	STM STATIONARY
24	150900Z	23.1N 128.8E	VW1-R-P5	1000ft	--	80	--	---	--/--	
25	150900Z	23.5N 128.6E	LND RDR	--	--	--	--	---	--/--	
26	151400Z	23.8N 128.8E	LND RDR	--	--	--	--	---	--/--	NAHA RDR STM STATIONARY EYE 81 MI DIA
27	151500Z	23.6N 128.8E	VW1-R-P2	700mb	75	--	--	---	--/--	EYE ELIP N-S

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
28	151500Z	24.1N 128.1E	LND RDR	--	--	--	--	----	--/--	MIYAKO JIMA RDR
29	151615Z	23.8N 129.0E	LND RDR	--	--	--	--	----	--/--	NAHA RDR EYE 74 MI DIA
30	152040Z	24.3N 129.0E	LND RDR	--	--	--	--	----	--/--	KADENA RDR
31	152100Z	24.1N 129.0E	54-P-P5	700mb	65	--	947	2637	17/--	EYE CIRC 20 MI DIA NO WALL CLDS SOLID MASS CLDS 80 MI DIA
32	152100Z	24.4N 129.2E	LND RDR	--	--	--	--	----	--/--	NAHA RDR STM MVG 030 DEG 08 KTS
33	152300Z	24.5N 129.5E	LND RDR	--	--	--	--	----	--/--	NAHA RDR
34	160035Z	24.5N 129.0E	TIROS	--	--	--	--	----	--/--	STAGE X, BNDS 4
35	160039Z	24.4N 129.3E	LND RDR	--	--	--	--	----	--/--	KADENA RDR
36	160143Z	24.8N 129.5E	LND RDR	--	--	--	--	----	--/--	KADENA RDR
37	160228Z	25.2N 129.8E	TIROS	--	--	--	--	----	--/--	STAGE X, DIA 6, BNDS 4 WELL DVLDPD EYE VSBL
38	160300Z	24.9N 129.9E	54-P-P3	700mb	80	70	950	2643	17/--	EYE CIRC 20 MI DIA FDR BNDS ALL QUADS
39	160945Z	26.3N 131.3E	LND RDR	--	--	--	--	----	--/--	NAHA RDR
40	161000Z	26.2N 131.2E	VW1-P-P2	1300ft	78	90	946	----	25/11	EYE CIRC 80 MI DIA
41	161200Z	26.7N 131.4E	VW1-R-U	1500ft	--	--	--	----	--/--	EYE OPEN SW QUAD
42	161210Z	26.5N 131.5E	LND RDR	--	--	--	--	----	--/--	KADENA RDR
43	161300Z	26.7N 131.7E	LND RDR	--	--	--	--	----	--/--	NAHA RDR

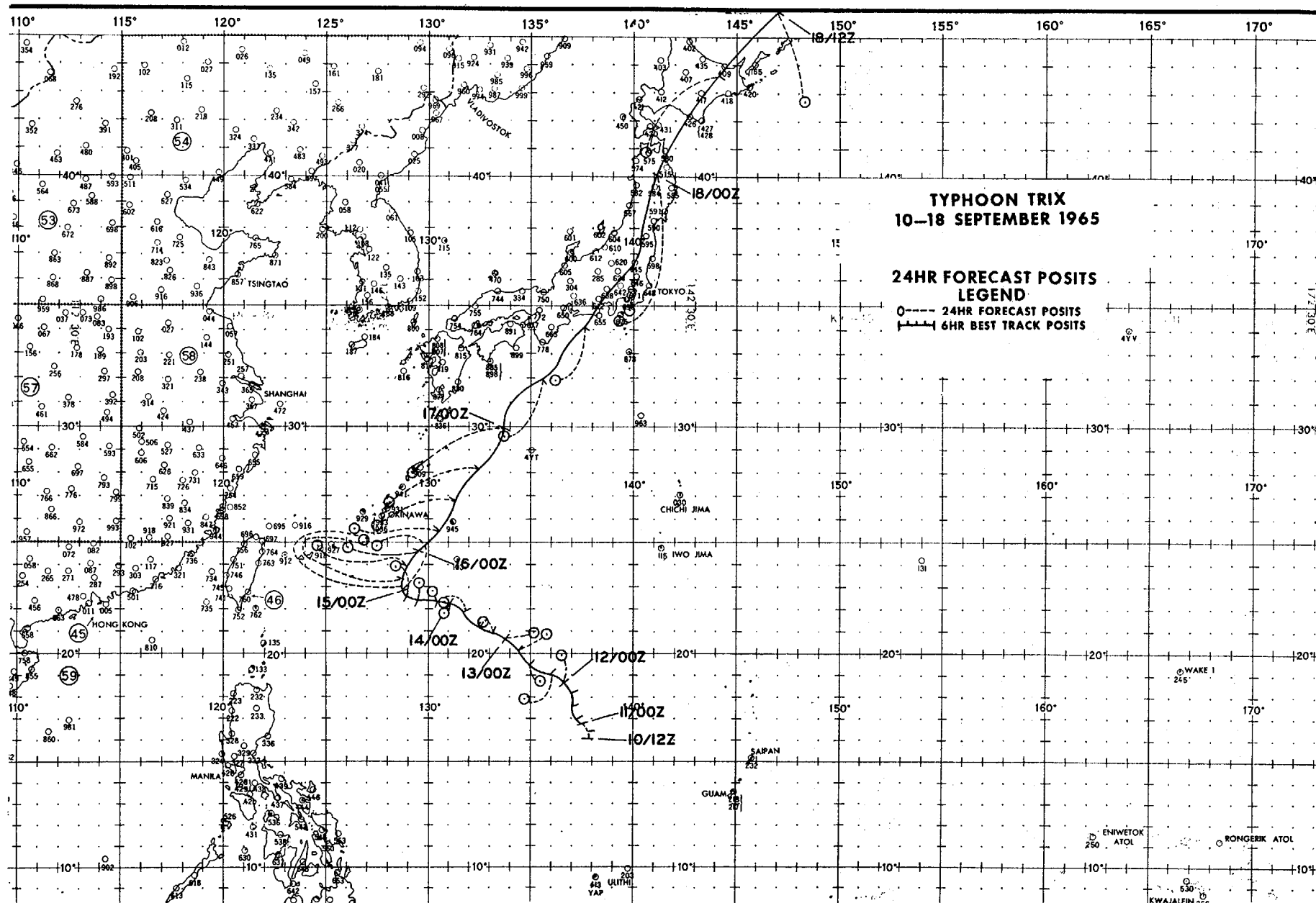
FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
44	161430Z	27.4N 131.8E	VW1-P-P3	1300ft	90	--	949	---	25/20	EYE CIRC 140 MI DIA. FDR BNDS ALL QUADS XCP SW
45	162100Z	28.7N 133.3E	54-P-P3	700mb	65	--	951	2685	17/--	EYE CIRC 100 MI DIA. EYE FILLED WITH CLDS
46	170200Z	32.0N 134.5E	TIROS	--	--	--	--	---	--/--	STAGE X, DIA 4.5, BNDS 3
47	170300Z	31.1N 134.1E	54-P-P3	700mb	100	130	956	2722	17/--	EYE CIRC 100 MI DIA
48	170600Z	31.6N 135.6E	LND RDR	--	--	--	--	---	--/--	FUJI RDR
49	170630Z	32.3N 135.5E	LND RDR	--	--	--	--	---	--/--	
50	170700Z	32.2N 136.0E	LND RDR	--	--	--	--	---	--/--	FUJI RDR
51	170830Z	33.0N 136.4E	VW1-R-P10	1100ft	65	60	979	---	21/18	EYE CIRC 12 MI DIA
52	170900Z	33.3N 136.6E	LND RDR	--	--	--	--	---	--/--	FUJI RDR
53	171200Z	34.4N 137.3E	LND RDR	--	--	--	--	---	--/--	FUJI RDR
54	171200Z	34.1N 137.3E	LND RDR	--	--	--	--	---	--/--	NAGOYA RDR
55	171300Z	34.6N 137.7E	LND RDR	--	--	--	--	---	--/--	FUJI RDR

TYPHOON TRIX 10 SEPT-18 SEPT 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
101200Z	16.0N	137.9E	-----	-----
101800Z	16.4N	137.8E	-----	-----
110000Z	16.7N	137.4E	-----	-----
110600Z	16.9N	137.2E	-----	-----
111200Z	17.6N	137.2E	-----	-----
111800Z	18.2N	137.0E	-----	-----
120000Z	18.6N	136.6E	352-74	-----
120600Z	19.0N	136.0E	226-100	-----
121200Z	19.4N	135.0E	151-44	-----
121800Z	20.1N	134.4E	063-90	-----
130000Z	20.6N	133.8E	079-79	032-161
130600Z	20.8N	133.2E	325-40	232-90
131200Z	21.1N	132.5E	341-10	128-100
131800Z	21.8N	131.7E	294-55	021-87
140000Z	22.2N	136.0E	221-24	050-70
140600Z	22.2N	130.4E	346-40	312-145
141200Z	22.3N	129.5E	007-55	335-77
141800Z	22.4N	128.9E	341-95	326-160
150000Z	22.7N	128.5E	333-138	319-114
150600Z	23.0N	128.7E	325-157	323-115
151200Z	23.3N	128.7E	314-145	314-197
151800Z	23.8N	128.9E	285-247	312-265
160000Z	24.5N	129.5E	275-180	318-340
160600Z	25.4N	130.5E	273-224	310-373
161200Z	26.7N	131.3E	254-216	290-355
161800Z	28.1N	132.5E	251-250	271-488
170000Z	29.9N	133.7E	244-256	255-497
170600Z	31.9N	135.5E	215-164	253-545
171200Z	34.2N	137.4E	203-153	242-560
171800Z	36.5N	139.8E	180-97	238-615
180000Z	40.1N	141.2E	194-350	230-528
180600Z	43.6N	144.2E	224-233	200-537
181200Z	45.9N	147.1E	165-205	191-524

AVERAGE 24 HOUR ERROR 138 MI

AVERAGE 48 HOUR ERROR 302 MI



TYPHOON VIRGINIA - 130600Z TO 170000Z SEPTEMBER

I. DATA

A. Statistics

1. Number of warnings issued - 16
2. Number of warnings with typhoon intensity - 4
3. Total distance traveled during tropical warning period - 1858 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 980mbs at 160930Z
2. Minimum observed 700mb height - 2999m. at 152115Z
3. Maximum surface wind - 65 kts (From Best Track)
4. Maximum radius of surface circulation - 300 mi

II. DEVELOPMENT

A. Initial impetus - Middle level low drifted northwest under a small rapidly developing high level anticyclone. System developed on low level inflow diverted from Typhoon TRIX.

B. Initial surface vortex

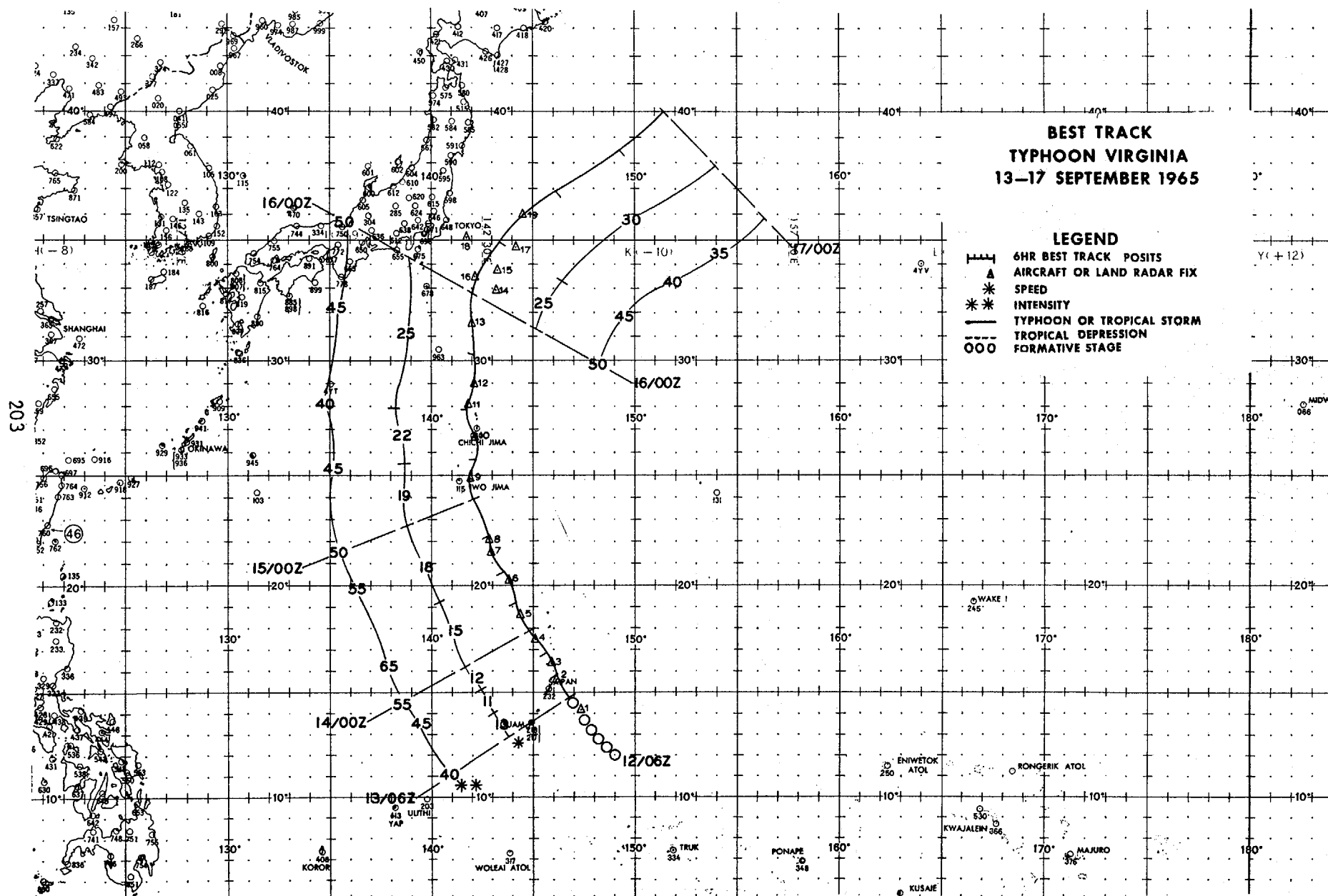
1. Junction vortex at 120600Z
2. Surface pressure less than 1006mbs

C. 200mb flow above surface vortex

1. Initial - northeast
2. Upon reaching typhoon intensity - under rapidly developing anticyclone

III. FINAL DISPOSITION

- A. Became extratropical



## EYE FIXES TYPHOON VIRGINIA

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	130343Z	14.2N 147.3E	54-P-P5	959mb	--	40	997	---	28/--	EYE CIRC 8 MI DIA
2	131000Z	15.6N 146.2E	VW1-R-F10	1500ft	28	35	---	---	--/--	
3	131445Z	16.3N 145.9E	VW1-R-F5	952mb	35	40	---	---	--/--	
4	132219Z	17.4N 145.1E	54-P-P4	700mb	--	50	994	3051	13/--	EYE CIRC 30 MI DIA
5	140315Z	18.6N 144.3E	54-P-P4	700mb	--	65	---	3048	15/--	EYE CIRC 25 MI DIA
6	141134Z	20.2N 143.8E	VW1-R-F5	957mb	28	--	---	---	--/--	
7	141433Z	21.5N 142.9E	VW1-P-P5	722mb	40	--	---	3081	15/--	WIND CNTR ELIP 19 X 13 NW-SE
8	142100Z	22.1N 142.8E	54-P-P3	700mb	33	50	989	3036	--/--	EYE CIRC 10 MI DIA. RDR EYE 40 MI SW OF 700MB CNTR
9	150300Z	24.8N 141.9E	54-P-P3	700mb	30	40	993	3036	10/--	RDR EYE 5 MI NW OF PRES EYE
10	150905Z	26.7N 142.2E	VW1-R-P5	963mb	26	20	---	---	--/--	EYE ELIP 20 X 15 NW-SE
11	151245Z	28.1N 141.8E	VW1-R-U	--	--	--	---	---	--/--	
12	151430Z	29.0N 142.1E	VW1-R-P1	1500ft	--	--	---	---	--/--	EYE CIRC 8 MI DIA. STM MOVG RAPIDLY
13	152115Z	31.6N 142.0E	54-P-F4	700mb	25	40	988	2999	16/--	EYE INDEF
14	160000Z	32.9N 143.2E	LND RDR	--	--	--	---	---	--/--	
15	160200Z	33.7N 143.3E	LND RDR	--	--	--	---	---	--/--	
16	160300Z	33.4N 142.1E	54-P-F1	700mb	55	40	---	2999	16/--	EYE INDEF



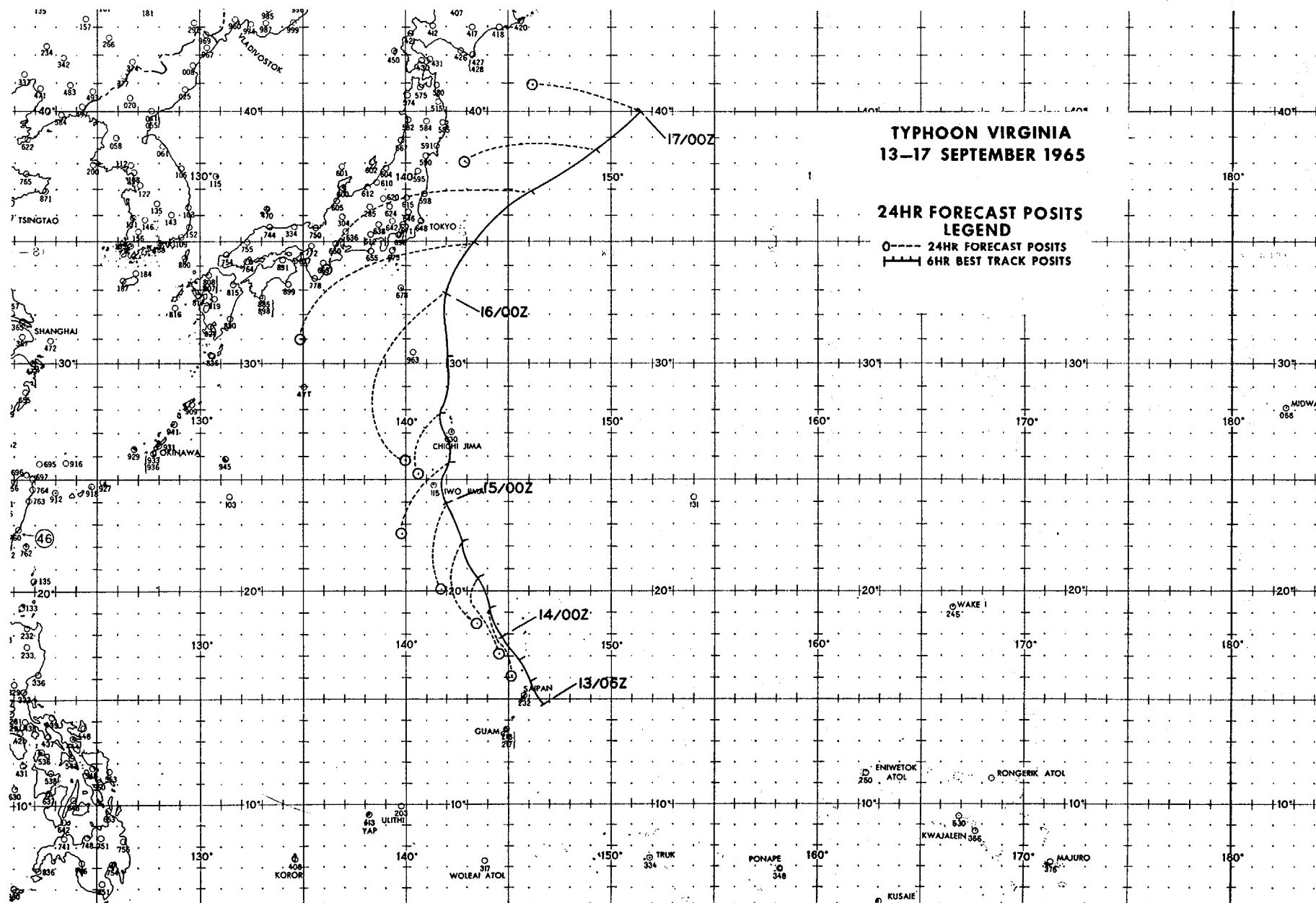
FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
17	160500Z	34.7N 144.2E	LND RDR	--	--	--	---	---	--/--	
18	160600Z	35.1N 141.7E	LND RDR	--	--	--	---	---	--/--	
19	160930Z	36.0N 144.5E	VW1-P-P5	940mb	25	30	980	---	24/21	EYE CIRC 15 MI DIA. FDR BNDS ABSENT NW SEMI

TYPHOON VIRGINIA 13 SEPT-17 SEPT 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
130600Z	14.7N	146.7E	-----	-----
131200Z	15.8N	146.1E	-----	-----
131800Z	16.8N	145.5E	-----	-----
140000Z	17.8N	144.7E	-----	-----
140600Z	19.2N	144.1E	159-194	-----
141200Z	20.6N	143.6E	165-210	-----
141800Z	22.2N	142.8E	169-225	-----
150000Z	23.8N	142.1E	185-222	-----
150600Z	25.7N	142.1E	214-224	178-472
151200Z	27.8N	141.7E	202-170	176-492
151800Z	30.3N	142.1E	-----	190-536
160000Z	32.8N	142.0E	194-425	197-605
160600Z	34.9N	143.3E	241-490	216-618
161200Z	36.8N	146.2E	249-518	228-570
161800Z	38.4N	149.3E	266-255	-----
170000Z	40.0N	151.4E	283-249	228-1012

AVERAGE 24 HOUR ERROR 289 MI

AVERAGE 48 HOUR ERROR 615 MI



TYPHOON BESS - 270600Z SEPTEMBER TO 041200Z OCTOBER

I. DATA

A. Statistics

1. Number of warnings issued - 30
2. Number of warnings with typhoon intensity - 29
3. Total distance traveled during tropical warning period - 1775 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 901mbs at 300300Z
2. Minimum observed 700mb height - 2265m. at 302100Z
3. Maximum surface wind - 150 kts (From Best Track)
4. Maximum radius of surface circulation - 850 mi

II. DEVELOPMENT

A. Initial impetus - Moderate easterly wave intensified under the southwesterly quadrant of an upper level anticyclone. Surge in Southern Hemisphere trades in the low levels intensified low.

B. Initial surface vortex

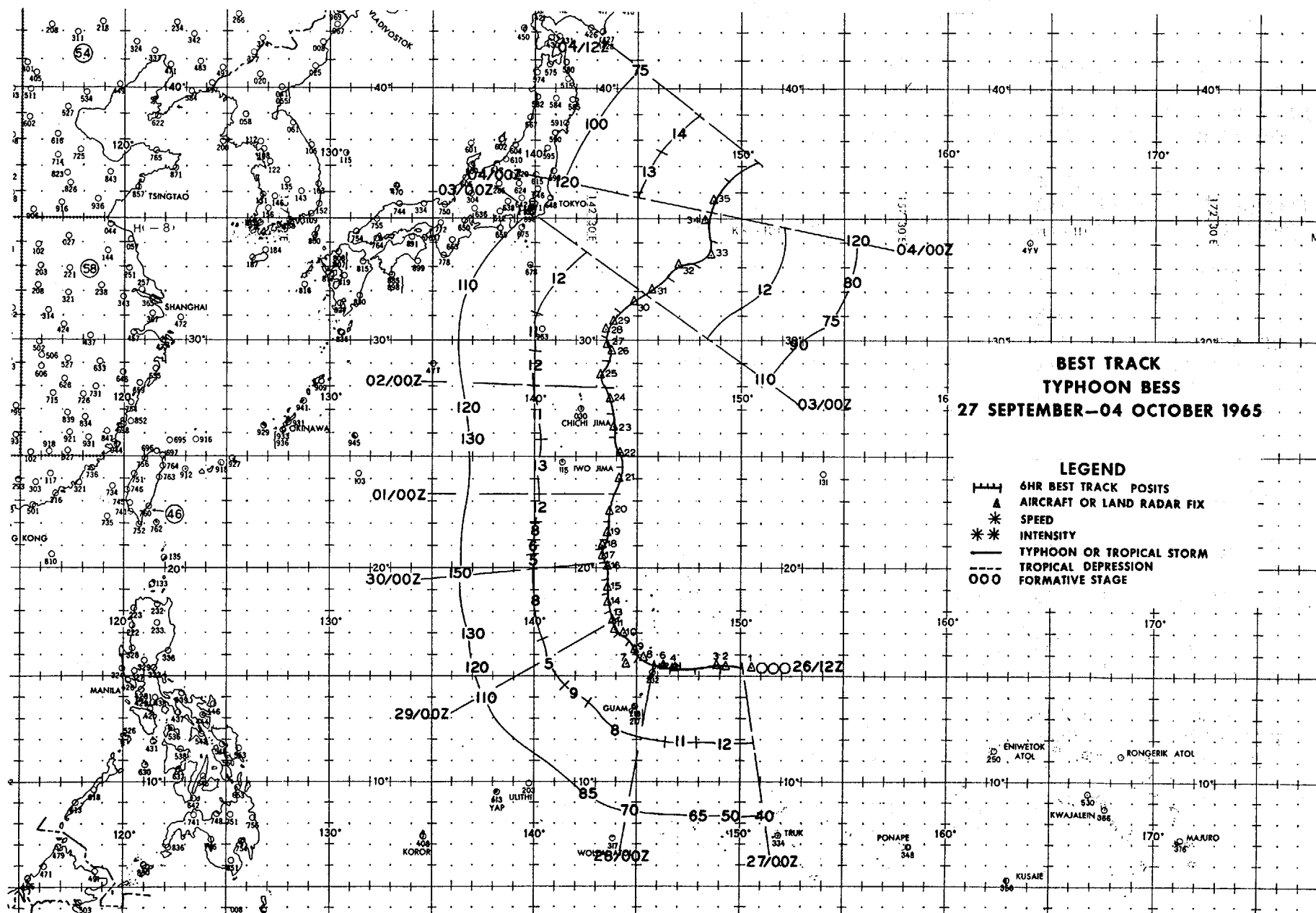
1. Imbedded vortex at 261200Z
2. Surface pressure less than 1008mbs

C. 200mb flow above surface vortex

1. Initial - southeasterly
2. Upon reaching typhoon intensity - east-northeasterly

III. FINAL DISPOSITION

A. Became extratropical



## EYE FIXES TYPHOON BESS

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	262250Z	15.3N 150.5E	707 Jet	31000ft	--	--	---	---	--/--	EYE 40 MI DIA. CURVED FDR BNDS. FIX MADE BY WORLD AIRWAYS 707 JET
2	270340Z	15.4N 149.3E	54-P-P5	1500ft	--	40	995	---	25/--	EYE CIRC 30 MI DIA. FDR BNDS ALL QUADS
3	270800Z	15.5N 148.8E	54-P-P7	700mb	40	70	995	3060	15/--	EYE CIRC 25 MI DIA
4	271500Z	15.3N 146.8E	54-P-P2	700mb	30	--	994	3042	19/--	EYE CIRC 40 MI DIA
5	271714Z	15.4N 146.5E	54-R-P5	700mb	--	--	---	---	--/--	EYE CIRC 25 MI DIA
6	272015Z	15.4N 146.3E	54-R-P3	700mb	41	65	989	3011	16/--	EYE OVAL 30 X 20 N-S
7	280128Z	15.5N 144.5E	TIROS	--	--	--	---	---	--/--	STAGE X, DIA 5, BNDS 2
8	280300Z	15.8N 145.3E	54-P-P1	700mb	48	95	966	2871	14/--	EYE CIRC 10 MI DIA. CNTR APPRS IN CONSTANT CHANGE
9	280825Z	16.2N 144.9E	VW1-P-P2	947mb	40	65	978	---	26/21	EYE CIRC 17 MI DIA
10	281433Z	17.0N 144.3E	VW1-P-P3	702mb	40	--	---	2877	17/11	EYE CIRC 23 MI DIA. RDR EYE 220 DEG 8 MI FM PRES TEMP EYE
11	282125Z	17.2N 143.9E	54-P-P5	850mb	75	130	---	---	--/--	SFC EYE CIRC 10 MI DIA. WALL CLD INNER DIA 20 MI
12	282210Z	17.3N 143.8E	54-P-P5	700mb	75	130	968	2838	18/--	EYE CIRC 8 MI DIA

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
13	290252Z	17.6N 143.8E	54-P-P5	700mb	75	85	967	2792	15/--	EYE CIRC 8 MI DIA
14	290830Z	18.4N 143.6E	VW1-R-P3	897mb	--	--	----	----	--/--	EYE CIRC 8 MI DIA
15	291440Z	19.1N 143.5E	VW1-R-P5	700mb	--	--	----	----	--/--	EYE CIRC 12 MI DIA
16	292125Z	20.1N 143.6E	54-P-P1	700mb	--	--	932	2506	17/--	EYE CIRC 15 MI DIA
17	300300Z	20.6N 143.3E	54-P-P1	700mb	130	--	901	2295	24/--	EYE CIRC 20 MI DIA
18	300830Z	21.0N 143.3E	VW1-R-P5	935mb	--	--	----	----	--/--	EYE CIRC 18 MI DIA
19	301430Z	21.6N 143.5E	VW1-R-P5	680mb	--	--	----	----	--/--	EYE CIRC 20 MI DIA
211 20	302100Z	22.6N 143.7E	54-P-P2	700mb	100	150	906	2265	23/--	EYE CIRC 20 MI DIA. SKY CLR ABOVE EYE
21	010330Z	24.0N 144.1E	54-P-PØ	700mb	73	150	924	2426	18/--	EYE CIRC 17 MI DIA
22	010900Z	25.2N 144.2E	VW1-R-P5	938mb	--	--	----	----	--/--	EYE CIRC 18 MI DIA
23	011440Z	26.3N 143.8E	VW1-R-P3	700mb	--	--	----	----	--/--	EYE CIRC 17 MI DIA
24	012110Z	27.5N 143.7E	54-P-P5	700mb	85	100	936	2560	22/--	EYE CIRC 20 MI DIA
25	020300Z	28.5N 143.2E	54-P-P4	700mb	85	150	943	----	21/--	EYE APPRS TO BE FILLING
26	020845Z	29.6N 143.8E	VW1-R-P2	700mb	--	--	----	----	--/--	EYE CIRC 13 MI DIA
27	021100Z	29.8N 143.6E	VW1-R-U	--	--	--	----	----	--/--	
28	021300Z	30.4N 143.5E	VW1-R-U	--	--	--	----	----	--/--	
29	021445Z	30.7N 143.8E	VW1-R-P2	700mb	--	--	----	----	--/--	EYE CIRC 10 MI DIA
30	022130Z	31.6N 144.8E	54-P-P4	700mb	60	150	962	2746	16/--	EYE CIRC 5 MI DIA

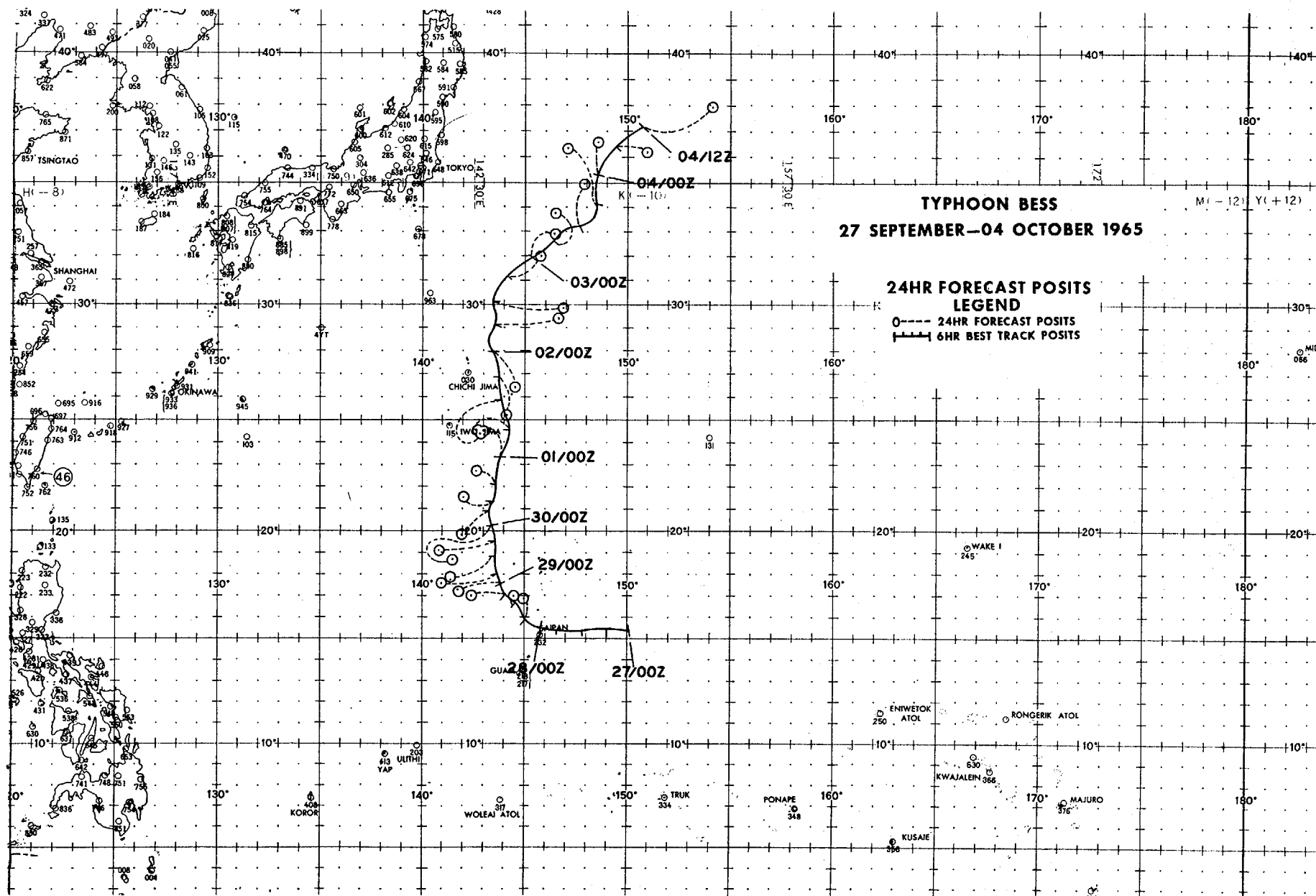
FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
31	030247Z	32.1N 145.7E	54-P-P2	700mb	55	110	972	2777	21/--	CNTR CIRC 4 MI DIA. NEG WALL CLDS
32	030915Z	33.1N 147.0E	VW1-P-P10	700mb	--	70	---	2816	16/15	EYE CIRC 9 MI DIA. POOR RDR EYE
33	031230Z	33.5N 148.6E	VW1-P-F10	700mb	--	--	---	2834	16/08	
34	032158Z	34.9N 148.3E	54-P-P5	700mb	55	75	969	2841	18/--	NO APPARENT EYE
35	040215Z	35.7N 148.7E	54-P-P5	700mb	70	140	969	2844	18/--	NEG EYE OR FDR BNDS



TYPHOON BESS 27 SEPT-04 OCT 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
270000Z	15.3N	150.2E	-----	-----
270600Z	15.4N	149.0E	-----	-----
271200Z	15.4N	147.8E	-----	-----
271800Z	15.4N	146.6E	-----	-----
280000Z	15.5N	145.8E	-----	-----
280600Z	15.9N	145.0E	357-58	-----
281200Z	16.6N	144.6E	346-28	-----
281800Z	17.0N	144.1E	270-97	-----
290000Z	17.5N	143.8E	266-114	-----
290600Z	18.0N	143.7E	260-153	274-143
291200Z	18.8N	143.6E	242-142	262-165
291800Z	19.5N	143.6E	260-155	264-329
300000Z	20.3N	143.4E	227-146	254-311
300600Z	20.8N	143.3E	230-92	255-348
301200Z	21.3N	143.5E	276-77	246-297
301800Z	22.1N	143.6E	304-62	258-304
010000Z	23.3N	143.9E	326-91	231-314
010600Z	24.5N	144.3E	271-87	231-275
011200Z	25.8N	143.9E	218-101	232-201
011800Z	26.8N	143.8E	168-100	227-106
020000Z	27.9N	143.4E	145-110	043-133
020600Z	29.1N	143.5E	083-172	075-84
021200Z	30.1N	143.5E	95-178	154-110
021800Z	31.2N	144.2E	058-97	128-140
030000Z	31.9N	145.3E	042-80	94-122
030600Z	32.6N	146.4E	004-65	58-418
031200Z	33.2N	147.7E	007-94	63-253
031800Z	34.2N	148.4E	335-145	44-360
040000Z	35.3N	148.5E	004-77	51-368
040600Z	36.4N	149.5E	98-77	55-330
041200Z	37.2N	150.8E	74-170	59-510

AVERAGE 24 HOUR ERROR 106 MI  
AVERAGE 48 HOUR ERROR 256 MI



TYPHOON CARMEN - 010600Z TO 100600Z OCTOBER

I. DATA

A. Statistics

1. Number of warnings issued - 37
2. Number of warnings with typhoon intensity - 18
3. Total distance traveled during tropical warning period - 2775 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 916mbs at 080300Z
2. Minimum observed 700mb height - 2289m. at 070226Z
3. Maximum surface wind - 150 kts (From Best Track)
4. Maximum radius of surface circulation - 825 mi

II. DEVELOPMENT

A. Initial impetus - Surge in the northeasterly trades

B. Initial surface vortex

1. Junction vortex at 300000Z
2. Surface pressure less than 1008mbs

C. 200mb flow above surface vortex

1. Initial - southerly flow
2. Upon reaching typhoon intensity - under anticyclone

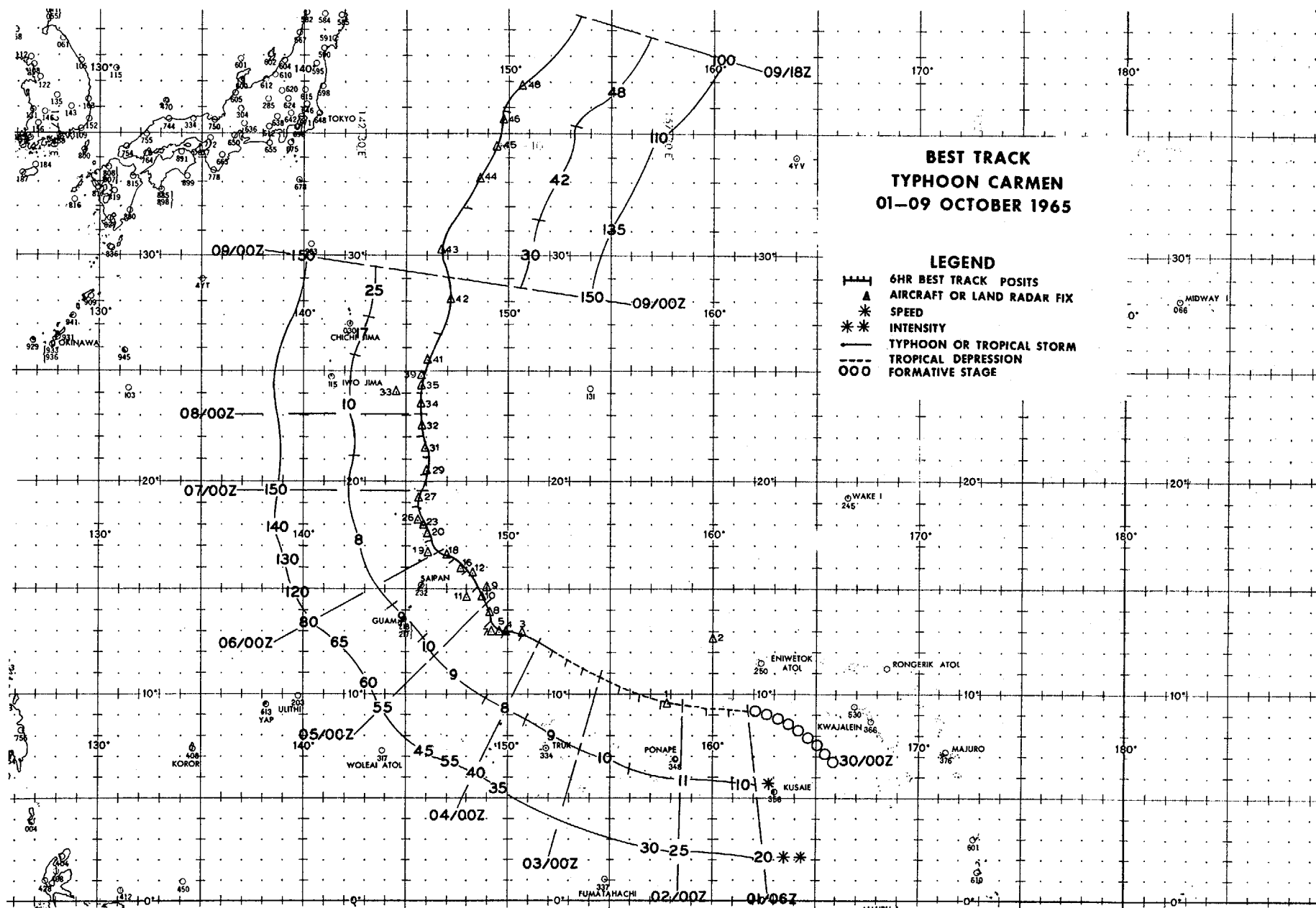
III. FINAL DISPOSITION

A. Became extratropical

# **BEST TRACK TYPHOON CARMEN 01-09 OCTOBER 1965**

**LEGEND**

- 6HR BEST TRACK POSITS
- ▲ AIRCRAFT OR LAND RADAR FIX
- \* SPEED
- \*\* INTENSITY
- TYPHOON OR TROPICAL STORM
- - - TROPICAL DEPRESSION
- OOO FORMATIVE STAGE



## EYE FIXES TYPHOON CARMEN

FLX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	020440Z	09.6N 157.8E	54-P-F3	700mb	--	30	1005	3075	10/--	CNTR CIRC 130 MI DIA
2	040237Z	12.6N 160.0E	54-P-P5	1500ft	25	120	994	---	26/--	EYE CIRC 5 MI DIA
3	040930Z	12.9N 150.7E	VW1-P-P5	972mb	25	20	999	---	22/18	CNTR CIRC 15 MI DIA. NO WALL CLD
4	041200Z	12.9N 149.9E	VW1-R-U	--	--	--	---	---	--/--	
5	041300Z	12.9N 149.6E	VW1-R-U	--	--	--	---	---	--/--	
6	041400Z	13.0N 149.4E	VW1-R-U	--	--	--	---	---	--/--	
7	041445Z	12.9N 149.2E	VW1-P-P5	690mb	30	--	---	---	08/05	CNTR CIRC 12 MI DIA. NO WALL CLD
8	042112Z	13.8N 149.1E	54-P-P3	700mb	--	45	991	3008	10/--	EYE CIRC 10 MI DIA. WALL CLD BUILDING E THRU N
9	050118Z	15.0N 149.0E	TIROS	--	--	--	---	---	--/--	STAGE D, DIA 4, BNDS 1
10	050200Z	14.6N 148.8E	C121	--	--	--	---	---	--/--	C121 ACFT RPT
11	050310Z	14.6N 148.0E	54-P-P3	700mb	--	55	987	2987	11/--	EYE CIRC 8 MI DIA
12	050855Z	15.7N 148.3E	VW1-P-P5	325m	40	45	981	---	26/20	EYE CIRC 8 MI DIA
13	051000Z	15.7N 148.1E	VW1-R-U	--	--	--	---	---	--/--	
14	051200Z	15.8N 148.0E	VW1-R-U	--	--	--	---	---	--/--	
15	051300Z	15.7N 147.8E	VW1-R-U	--	--	--	---	---	--/--	

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
16	051400Z	15.9N 147.7E	VW1-R-U	--	--	--	----	----	--/--	
17	051455Z	16.0N 147.6E	VW1-P-P3	700mb	60	--	----	2871	14/09	EYE CIRC 15 MI DIA
18	052100Z	16.6N 147.0E	54-P-P5	700mb	71	65	969	2800	15/--	RDR SHOWS ONE EYE 10 MI DIA AND ONE SMALL EYE 3 MI DIA POSITD AGAINST S WALL CLD. LOWEST PRES & SFC CALM IN SMALL EYE
19	060300Z	16.6N 146.1E	54-P-P5	700mb	95	120	950	2661	19/--	"PERFECT" EYE CIRC 8 MI DIA
20	060830Z	17.6N 146.1E	VW1-R-P3	955m	--	--	----	----	--/--	CLASSIC PRESENTATION. EYE CIRC 7 MI DIA
21	061000Z	17.7N 146.2E	VW1-R-U	--	--	--	----	----	--/--	
22	061100Z	17.8N 146.1E	VW1-R-U	--	--	--	----	----	--/--	
23	061200Z	17.9N 145.9E	VW1-R-U	--	--	--	----	----	--/--	
24	061300Z	See Remarks	VW1-R-U	--	--	--	----	----	--/--	EYE CNTRD OVER PAGEN ISLAND, M.I.
25	061400Z	18.2N 145.7E	VW1-R-U	--	--	--	----	----	--/--	
26	061430Z	18.2N 145.6E	VW1-R-P3	685mb	--	--	----	----	--/--	EYE CIRC 7 MI DIA
27	062108Z	19.2N 145.6E	54-P-P5	700mb	115	150	923	2399	19/--	EYE CIRC 7 MI DIA. SMALLER INNER EYE 3 MI DIA AGAINST W WALL CLD WITHIN LARGER EYE
28	070226Z	19.4N 145.7E	54-P-P10	700mb	110	175	----	2289	24/--	EYE CIRC 5 MI DIA

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
29	070845Z	20.4N 146.0E	VW1-R-P5	274m	--	--	----	----	--/--	EYE ELIP 7 X 6 N-S. BNDS VERY TIGHT OUT TO 25 MI. XTNSV PACKED BNDS TO 60 MI NE QUAD
30	071030Z	20.8N 146.1E	VW1-R-U	--	--	--	----	----	--/--	
31	071445Z	21.4N 145.9E	VW1-R-P5	351m	--	--	----	----	--/--	EYE CIRC 8 MI DIA. TIGHT BNDS AROUND CNTR
32	072100Z	22.5N 145.7E	54-P-P5	700mb	75	150	919	2381	22/--	EYE CIRC 15 MI DIA. CLASSIC FDR BNDS ALL QUADS
33	080130Z	24.0N 144.5E	TIROS	--	--	--	----	----	--/--	STAGE X, DIA 7, BNDS 4 EYE DIMLY VSBL
34	080300Z	23.4N 145.7E	54-P-P10	700mb	125	150	916	2341	23/--	EYE CIRC 18 MI DIA. HUB CLD TOP TO 12000 FT 1 MI N SFC CNTR
35	080730Z	24.3N 145.7E	VW1-R-U	--	--	--	----	----	--/--	
36	080840Z	24.4N 145.6E	VW1-R-P5	244m	--	--	----	----	--/--	EYE CIRC 12 MI DIA
37	081000Z	24.5N 145.7E	VW1-R-U	--	--	--	----	----	--/--	
38	081100Z	24.7N 145.7E	VW1-R-U	--	--	--	----	----	--/--	
39	081200Z	24.8N 145.7E	VW1-R-U	--	--	--	----	----	--/--	
40	081300Z	25.1N 145.7E	VW1-R-U	--	--	--	----	----	--/--	
41	081430Z	25.4N 146.0E	VW1-R-P5	700mb	--	--	----	----	--/--	EYE CIRC 10 MI DIA
42	082235Z	28.1N 147.1E	54-P-P3	700mb	80	--	945	2618	15/--	EYE OVAL 10 X 7 N-S. LGT RAIN IN EYE

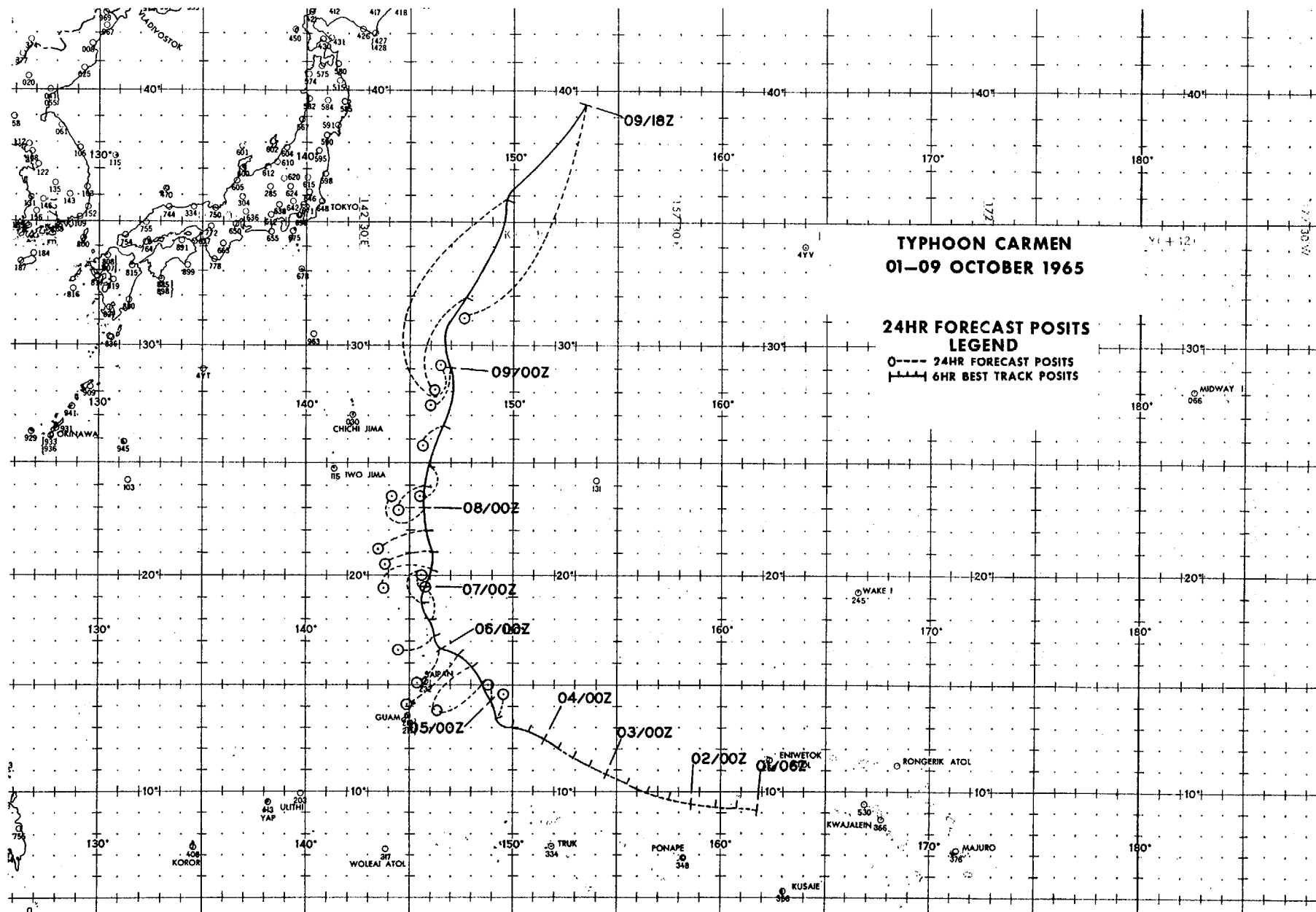
FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
43	090300Z	30.2N 146.7E	54-P-P3	700mb	--	150	956	2734	14/--	EYE CIRC 8 MI DIA. WALL CLD LGT MOD 10 MI THK N QUAD ONLY. FDR BNDS ALL QUADS
44	090850Z	33.2N 148.6E	VW1-R-F10	396m	--	--	---	---	--/--	NEG DEFINED BNDS, VERY POORLY DEFINED RDR EYE
45	091000Z	34.4N 149.4E	VW1-R-U	--	--	--	---	---	--/--	
46	091100Z	35.5N 149.7E	VW1-R-U	--	--	--	---	---	--/--	
47	091200Z	35.8N 149.7E	VW1-R-U	---	--	--	---	---	--/--	
48	091401Z	36.8N 150.6E	VW1-P-P5	700mb	100	100	---	2775	--/--	NEG RDR PRESENTATION, EYE HELD VISUAL
49	100200Z	45.0N 154.2E	54-P-P3	700mb	--	--	997	2829	11/--	CNTR CIRC 20 MI DIA



TYPHOON CARMEN 01 OCT-09 OCT 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
010600Z	09.2N	161.8E	-----	-----
011200Z	09.3N	160.8E	-----	-----
011800Z	09.3N	159.7E	-----	-----
020000Z	09.4N	158.6E	-----	-----
020600Z	09.6N	157.5E	-----	-----
021200Z	10.0N	156.4E	-----	-----
021800Z	10.3N	155.4E	-----	-----
030000Z	10.7N	154.5E	-----	-----
030600Z	11.2N	153.7E	-----	-----
031200Z	11.6N	152.9E	-----	-----
031800Z	12.0N	152.2E	-----	-----
040000Z	12.4N	151.5E	-----	-----
040600Z	12.7N	150.7E	-----	-----
041200Z	12.9N	149.9E	-----	-----
041800Z	13.4N	149.2E	019-73	-----
050000Z	14.3N	149.0E	348-41	-----
050600Z	15.1N	148.4E	232-138	-----
051200Z	15.8N	148.0E	224-155	-----
051800Z	16.4N	147.3E	226-198	-----
060000Z	16.6N	146.5E	220-121	-----
060600Z	17.3N	146.2E	246-105	237-239
061200Z	18.0N	145.9E	175-90	234-252
061800Z	18.7N	145.5E	004-75	238-259
070000Z	19.5N	145.7E	353-33	243-145
070600Z	20.3N	146.0E	248-130	273-110
071200Z	21.1N	146.1E	254-137	348-150
071800Z	22.0N	145.8E	249-137	002-205
080000Z	23.0N	145.7E	285-84	355-60
080600Z	24.0N	145.7E	222-92	244-156
081200Z	24.9N	145.8E	193-96	240-158
081800Z	26.6N	146.6E	227-74	236-204
090000Z	29.1N	147.0E	208-112	228-164
090600Z	32.0N	147.8E	200-240	208-347
091200Z	35.8N	149.7E	202-416	200-497
091800Z	39.6N	153.5E	210-555	208-617

AVERAGE 24 HOUR ERROR 148 MI  
AVERAGE 48 HOUR ERROR 238 MI



TYPHOON DELLA - 130000Z TO 191800Z OCTOBER

I. DATA

A. Statistics

1. Number of warnings issued - 28
2. Number of warnings with typhoon intensity - 20
3. Total distance traveled during tropical warning period - 2100 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 970mbs at 171430Z
2. Minimum observed 700mb height - 2850m. at 162055Z
3. Maximum surface wind - 85 kts (From Best Track)
4. Maximum radius of surface circulation - 900 mi

II. DEVELOPMENT

A. Initial impetus - A small anticyclone at 200mb drifted over the junction vortex. The system developed by diverting the low level Southern Hemisphere inflow from T. D. 36.

B. Initial surface vortex

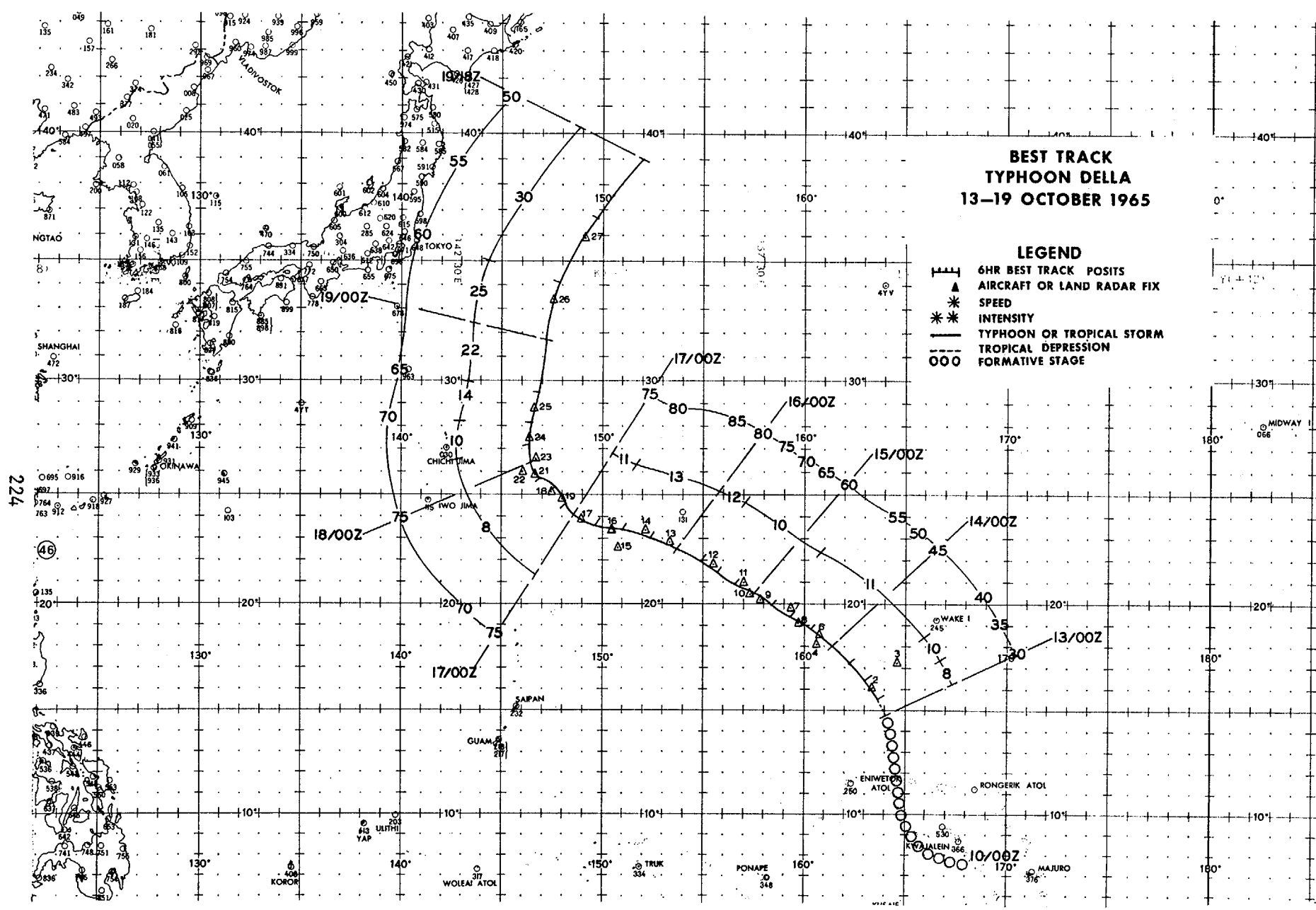
1. Junction vortex at 100000Z
2. Surface pressure less than 1008mbs

C. 200mb flow above surface vortex

1. Initial - center of small anticyclone
2. Upon reaching typhoon intensity - south quad of anticyclone

III. FINAL DISPOSITION

A. Became extratropical



**BEST TRACK  
TYPHOON DELLA  
13-19 OCTOBER 1965**

**LEGEND**

- 6HR BEST TRACK POSITS
- AIRCRAFT OR LAND RADAR FIX
- SPEED
- INTENSITY
- TYPHOON OR TROPICAL STORM
- TROPICAL DEPRESSION
- FORMATIVE STAGE

224

## EYE FIXES TYPHOON DELLA

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	122345Z	16.1N 163.2E	54-P-U	700mb	--	--	---	3100	11/--	ESTIMATED FROM RECON
2	130850Z	16.1N 163.3E	VW1-P-P5	1100ft	--	--	995	---	23/19	CNTR ILL DEFINED. FDR BNDS FORMING E THRU W
3	131510Z	17.3N 164.6E	VW1-R-P3	1380ft	--	35	998	---	23/16	EYE CIRC 7 MI DIA
4	132220Z	18.1N 160.6E	54-P-P3	1500ft	--	45	996	---	25/--	CNTR INDISTINCT. WX BNDS CIRCLE AREA
5	132309Z	18.1N 160.6E	SB123 ACFT	16000ft	--	--	---	---	--/--	PILOT RPTD EYE FILLED WITH THIN CLDS
225 6	140300Z	18.4N 160.8E	54-P-P3	1500ft	--	50	992	3048	26/--	CNTR INDISTINCT. MAX WND AND WX 360/230 MI FM CNTR
7	140915Z	19.8N 159.3E	VW1-P-P3	1200ft	22	--	990	---	25/21	HOOK EYE SHAPE 25 MI DIA WX FDR BND 150 MI NE TO 100 MI W TO 50 MI SE
8	141445Z	19.1N 159.7E	VW1-P-P3	1100ft	--	--	988	---	25/23	EYE CIRC 4 MI DIA. WALL CLDS ALL QUADS TO 40000 FT
9	142100Z	20.2N 157.8E	54-P-P2	700mb	--	60	987	2999	15/--	CNTR INDISTINCT. MAX SFC WND 060/150 MI FM CNTR
10	150300Z	20.4N 157.3E	54-P-P4	700mb	--	75	980	2932	16/--	CNTR INDEFINITE. MAX SFC WND 050/80 MI FM CNTR
11	150915Z	21.0N 157.0E	VW1-P-P5	1150ft	--	--	984	---	25/21	NO RDR EYE. WEAK FDR BNDS ALL QUADS
12	151445Z	21.8N 155.4E	VW1-P-P3	1110ft	--	--	979	---	26/23	NO RDR CNTR

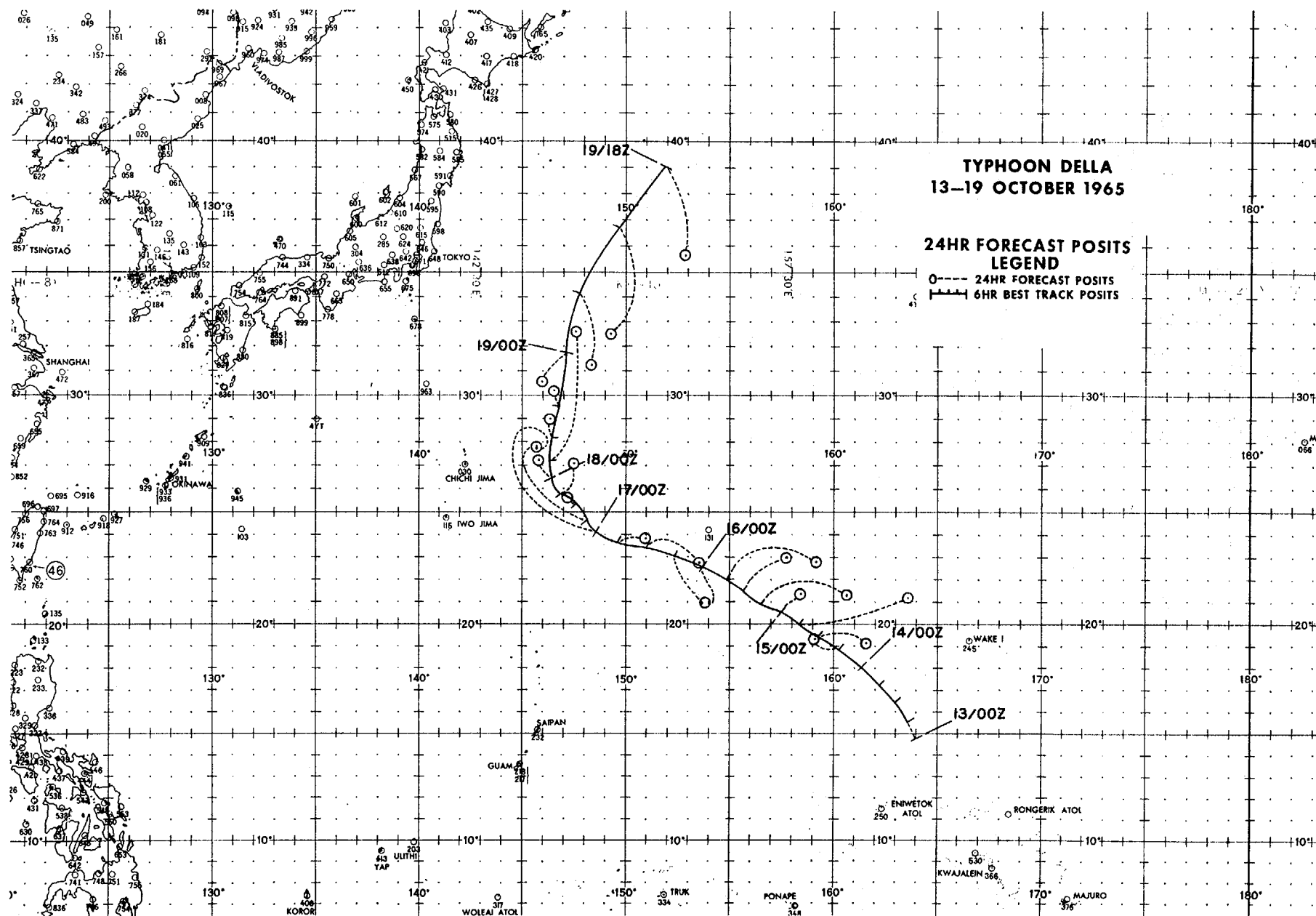
FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
13	152245Z	22.8N 153.3E	54-P-F10	700mb	80	50	982	2920	17/--	CNTR 40 MI DIA
14	160312Z	23.3N 152.1E	54-P-P10	700mb	80	90	977	2880	16/--	CNTR LARGE AREA LGT WND MAX SFC WND 180/140 MI FM CNTR
15	160855Z	22.6N 150.8E	VW1-P-P5	950mb	60	40	971	---	25/18	CNTR DISORGANIZED. PSBL RDR CNTR 037/7 MI
16	161445Z	23.4N 150.4E	VW1-P-P10	950mb	--	45	971	---	25/20	CNTR ELIP NW-SE 40 X 25 MI
17	162055Z	23.9N 148.9E	54-P-P5	700mb	65	65	971	2850	17/--	CNTR CIRC 30 MI DIA
18	170243Z	25.2N 147.4E	54-P-P5	700mb	65	65	973	2865	17/--	CNTR OVAL N-S 40 X 80 MI
19	170830Z	24.8N 148.0E	VW1-P-P5	800ft	70	65	963	---	--/--	CNTR CIRC 40 MI DIA MAX SFC WND 40-90 MI SW QUAD
20	171430Z	25.3N 147.4E	VW1-P-P5	1500ft	--	--	970	2945	25/22	CNTR CIRC 11 MI DIA. NO FDR BNDS
21	172120Z	25.9N 146.6E	54-P-F15	700mb	--	100	978	2923	16/--	CNTR CIRC 6 MI DIA
22	180133Z	26.0N 146.0E	TIROS	--	--	--	---	---	--/--	STAGE X, DIA 5, BNDS 3
23	180250Z	26.6N 146.6E	54-P-P10	700mb	75	90	980	2944	16/--	NO RDR PICTURE
24	180910Z	27.5N 146.3E	VW1-P-P3	244m	46	45	976	---	25/--	CNTR CIRC 5 MI DIA
25	181450Z	28.8N 146.6E	VW1-P-P5	952mb	--	--	976	2929	25/--	CNTR CIRC 7 MI DIA
26	190355Z	33.4N 147.5E	54-P-P3	700mb	--	65	982	2896	15/--	CNTR INDEFINITE
27	191030Z	36.0N 149.1E	VW1-P-P10	955mb	54	--	995	---	23/20	CNTR CIRC 8 MI DIA

TYPHOON DELLA 13 OCT-19 OCT 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR	48 HOUR ERROR
	LAT.	LONG.	DEG. DISTANCE	DEG. DISTANCE
130000Z	14.8N	164.0E	-----	-----
130600Z	15.6N	163.6E	-----	-----
131200Z	16.4N	163.0E	-----	-----
131800Z	17.2N	162.2E	-----	-----
140000Z	18.0N	161.3E	-----	-----
140600Z	18.8N	160.3E	296-73	-----
141200Z	19.4N	159.3E	97-125	-----
141800Z	20.0N	158.3E	76-308	-----
150000Z	20.4N	157.4E	45-77	-----
150600Z	20.9N	156.5E	84-208	-----
151200Z	21.5N	155.7E	51-142	-----
151800Z	22.0N	154.9E	80-247	68-408
160000Z	22.5N	153.7E	170-103	56-276
160600Z	23.0N	152.3E	149-146	78-456
161200Z	23.4N	151.0E	104-144	61-447
161800Z	23.6N	149.6E	81-77	75-648
170000Z	24.1N	148.6E	324-273	145-192
170600Z	24.6N	148.1E	326-230	156-196
171200Z	25.3N	147.6E	317-28	115-170
171800Z	25.7N	146.8E	23-91	60-37
180000Z	26.4N	146.4E	324-58	19-517
180600Z	27.2N	146.3E	11-342	17-383
181200Z	28.2N	146.4E	358-47	292-50
181800Z	29.5N	146.8E	335-38	43-87
190000Z	31.7N	147.2E	223-89	22-165
190600Z	34.2N	147.8E	172-177	50-521
191200Z	36.7N	149.7E	185-255	168-93
191800Z	39.0N	152.0E	168-212	140-66

AVERAGE 24 HOUR ERROR 152 MI

AVERAGE 48 HOUR ERROR 277 MI





TYPHOON FAYE - 140000Z TO 260000Z NOVEMBER

I. DATA

A. Statistics

1. Number of warnings issued - 49
2. Number of warnings with typhoon intensity - 21
3. Total distance traveled during tropical warning period - 4001 mi

B. Characteristics as a typhoon

1. Minimum observed SLP - 925mbs at 232142Z
2. Minimum observed 700mb height - 2324m. at 230945Z
3. Maximum surface wind - 135 kts (From Best Track)
4. Maximum radius of surface circulation - 700 mi

II. DEVELOPMENT

A. Initial impetus - Low level inflow of Southern Hemisphere air with divergence aloft behind MPT

B. Initial surface vortex

1. Junction vortex at 100000Z
2. Surface pressure less than 1008mbs

C. 200mb flow above surface vortex

1. Initial - north
2. Upon reaching typhoon intensity - northeast

III. FINAL DISPOSITION

A. Became extratropical

**BEST TRACK  
TYPHOON FAYE  
14-26 NOVEMBER 1965**

**LEGEND**  
 [---] 6HR BEST TRACK POSITS  
 [▲] AIRCRAFT OR LAND RADAR FIX  
 \* SPEED  
 \*\* INTENSITY  
 --- TYPHOON OR TROPICAL STORM  
 --- TROPICAL DEPRESSION  
 OOO FORMATIVE STAGE

NEW VORTEX FORMED  
WITHIN SAME MAJOR  
CIRCULATION

## EYE FIXES TYPHOON FAYE

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
1	120208Z	08.0N 166.2E	SA-16	--	--	25	--	---	--/--	TRUST TERRITORIES ACFT
2	130445Z	07.9N 168.0E	54-P-P1	950mb	15	30	1001	---	24/--	MAX WND IN BND 20 TO 25 MI WIDE S QUAD
3	132315Z	08.2N 167.2E	54-P-P1	950mb	30	35	1003	---	--/--	CIRCN WEAK E & W, STRONG N & S
4	140300Z	08.1N 167.9E	54-P-P1	700mb	20	40	1001	3085	12/--	MAX WND TO S IN SHARP BND
5	142100Z	08.9N 167.0E	54-P-P3	1500ft	--	30	1002	---	24/--	FDR BNDS W & S. CNTR CIRC 10 MI DIA
6	150225Z	09.3N 167.4E	54-P-F0	1500ft	--	25	998	---	25/--	CNTR CIRC 30 MI DIA
7	152100Z	08.7N 164.6E	54-P-F3	1500ft	30	25	1004	---	24/--	LARGE CIRC. MAX WINDS 100 MI N OF CNTR. CNTR CIRC 40 MI DIA
8	160321Z	09.5N 163.6E	54-P-P3	1500ft	40	40	1004	---	24/--	CNTR OVAL NE-SW 40 X 100 MI
9	162130Z	08.9N 161.8E	54-P-F7	1500ft	32	32	1007	---	24/--	PRESS CNTR IN S EDGE OF LARGE CIRC
10	170208Z	09.4N 160.7E	54-P-P3	1500ft	38	38	1004	---	25/--	CURVING BND OF BUILD-UP S & W CNTR CIRC 8 MI DIA
11	172130Z	09.1N 156.7E	54-P-F5	1500ft	10	30	1006	---	23/--	CNTR CIRC 100 MI DIA
12	180250Z	09.3N 156.0E	54-P-P3	1500ft	25	25	1003	---	24/--	CNTR CIRC 75 MI DIA
13	182125Z	10.1N 152.5E	54-P-P5	1500ft	30	35	1004	---	25/--	NO FDR BNDS

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
14	190255Z	10.1N 151.7 E	54-P-P5	1500ft	50	40	1001	---	26/--	ALL SFC WND S CONVERGE ON CONFUSED CNTR NO CALM AREA
15	190915Z	10.2N 149.5E	VW1-P-F10	964mb	48	40	1000	---	22/18	RDR CNTR 30 MI S RPTD CNTR CNTR CIRC 55 MI DIA
16	191145Z	08.6N 148.7E	VW1-R-U	---	--	--	---	---	--/--	TIGHT RDR EYE FRMG
17	191445Z	08.7N 148.4E	VW1-P-P10	962mb	--	--	999	---	24/22	HVY BNDG SSE THRU NE CNTR TO N FLG
18	192120Z	09.3N 147.7E	54-P-F5	1500ft	35	35	1003	---	23/--	CNTR IS BROAD CALM AREA 55 MI NW-SE
19	200144Z	10.0N 147.0E	TIROS	---	--	--	---	---	--/--	STAGE X, DIA 3, BNDS 1
20	200315Z	09.9N 146.7E	54-P-P3	1500ft	40	40	999	---	24/--	CNTR CIRC 20 MI DIA
21	200900Z	10.5N 145.5E	VW1-P-P10	1500ft	--	45	998	---	--/--	STM WK BUT FDR BNDS ALL QUADS
22	201508Z	10.6N 143.5E	VW1-P-P5	700mb	55	--	995	3063	11/4	CNTR CIRC 13 MI DIA
23	202110Z	10.3N 142.2E	54-P-P5	700mb	75	65	987	2984	13/--	FDR BNDS ALL QUADS CNTR CIRC 5 MI DIA
24	210215Z	10.8N 141.0E	TIROS	---	--	--	---	---	--/--	STAGE X, DIA 2½, BNDS 3
25	210325Z	11.0N 140.5E	54-P-P5	700mb	75	75	986	2966	13/--	CNTR CIRC 5 MI DIA. WALL CLDS BLDG E & S
26	210819Z	11.4N 139.1E	VW1-P-P5	944mb	--	55	975	---	24/22	CNTR CIRC 5 MI DIA NO WALL CLDS

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
27	211440Z	11.7N 137.6E	VW1-R-P5	700mb	--	--	---	---	--/--	CNTR CIRC 10 MI DIA
28	212121Z	11.9N 135.8E	54-P-P3	700mb	75	120	952	2691	19/--	EYE CIRC 10 MI DIA WALL CLD ALL QUADS
29	220237Z	12.0N 134.0E	TIROS	---	--	--	--	---	--/--	STAGE X, DIA 6, BNDS 4
30	220322Z	12.4N 134.3E	54-P-P3	700mb	62	130	951	2698	23/--	EYE CIRC 18 MI DIA
31	220835Z	12.6N 133.4E	VW1-P-P5	684mb	92	130	--	2573	15/13	EYE CIRC 10 MI DIA
32	221225Z	12.9N 132.5E	VW1-R-U	---	--	--	--	---	--/--	
33	221420Z	13.4N 131.6E	VW1-R-P5	700mb	--	--	--	---	--/--	EYE CIRC 10 MI DIA
34	222100Z	14.0N 130.6E	54-P-P5	700mb	115	--	936	2579	16/--	EYE CIRC 30 MI DIA SMALL INNER EYE FRMG
35	230157Z	15.0N 129.5E	TIROS	---	--	--	--	---	--/--	STAGE X, DIA 7, BNDS 4 EYE VSBL
36	230235Z	14.8N 129.3E	54-P-P5	700mb	110	130	932	2521	20/--	EYE CIRC 20 MI DIA RDR EYE 8 MI N SFC CNTR
37	230945Z	15.8N 128.2E	VW1-P-P5	714mb	54	90	--	2324	23/17	EYE CIRC 20 MI DIA
38	231430Z	16.6N 127.8E	VW1-P-P5	713mb	95	--	--	2395	22/16	COUNTER-CLOCKWISE LOOP BTN 1100Z AND 1330Z
39	232142Z	17.9N 127.1E	54-P-P2	700mb	--	140	925	2445	17/--	EYE OVAL NNE-SSW 25 X 20
40	240217Z	18.8N 126.9E	54-P-P4	700mb	--	150	932	2506	19/--	EYE CIRC 20 MI DIA
41	240850Z	20.4N 127.4E	VW1-P-P5	711mb	80	130	--	2579	20/13	RDR EYE CIRC 35 MI DIA WND EYE 12 MI DIA

FIX NO.	TIME	POSIT	UNIT- METHOD -ACCY	FLT LVL	FLT LVL WND	OBS SFC WND	OBS MIN SLP	MIN 700MB HGT	FLT LVL TT/TD	REMARKS
42	241230Z	21.9N 127.8E	VW1-R-U	--	--	--	--	---	--/--	EYE DIA 45 MI
43	241645Z	23.2N 128.7E	VW1-R-P15	--	--	--	--	---	--/--	EYE CIRC 28 MI DIA
44	242100Z	24.4N 130.4E	54-P-P3	700mb	75	--	950	2640	16/--	EYE CIRC 20 MI DIA
45	250330Z	26.6N 132.5E	54-P-P5	700mb	100	130	960	2731	21/--	NO FDR BNDS, WALL CLD WK N QUAD ONLY

TYPHOON FAYE 14 NOV-26 NOV 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR		48 HOUR ERROR	
	LAT.	LONG.	DEG.	DISTANCE	DEG.	DISTANCE
140000Z	08.1N	168.1E	-----		-----	
140600Z	08.4N	167.8E	-----		-----	
141200Z	08.6N	167.6E	-----		-----	
141800Z	08.8N	167.3E	-----		-----	
150000Z	09.1N	166.8E	-----		-----	
150600Z	09.2N	166.2E	117-60		-----	
151200Z	09.2N	165.5E	102-72		-----	
151800Z	09.4N	164.9E	98-86		-----	
160000Z	09.5N	164.2E	87-103		-----	
160600Z	09.6N	163.5E	73-147		042-75	
161200Z	09.5N	162.8E	59-153		073-128	
161800Z	09.4N	162.0E	54-180		075-165	
170000Z	09.4N	161.3E	112-205		068-195	
170600Z	09.4N	160.1E	16-135		065-274	
171200Z	09.4N	158.9E	23-166		048-275	
171800Z	09.2N	157.7E	45-222		048-307	
180000Z	09.2N	156.5E	56-195		083-393	
180600Z	09.5N	155.4E	50-105		035-244	
181200Z	09.8N	154.3E	53-106		039-251	
181800Z	10.1N	153.4E	53-106		047-271	
190000Z	10.1N	152.4E	295-58		053-235	
190600Z	10.1N	150.9E	345-33		048-148	
191200Z	10.2N	149.2E	27-55		055-201	
191800Z	08.9N	148.1E	09-151		041-265	
200000Z	09.4N	147.5E	352-118		346-143	
200600Z	10.2N	146.3E	09-78		358-108	
201200Z	10.6N	144.8E	357-60		009-98	
201800Z	10.5N	143.1E	02-57		019-136	
210000Z	10.5N	141.4E	70-92		030-135	
210600Z	11.3N	139.9E	90-99		055-135	
211200Z	11.6N	138.4E	92-106		056-111	
211800Z	11.8N	136.7E	083-24		070-105	
220000Z	12.1N	135.1E	130-67		095-168	
220600Z	12.5N	133.9E	225-39		100-165	
221200Z	12.7N	132.7E	263-85		102-159	
221800Z	13.5N	131.3E	240-78		061-21	

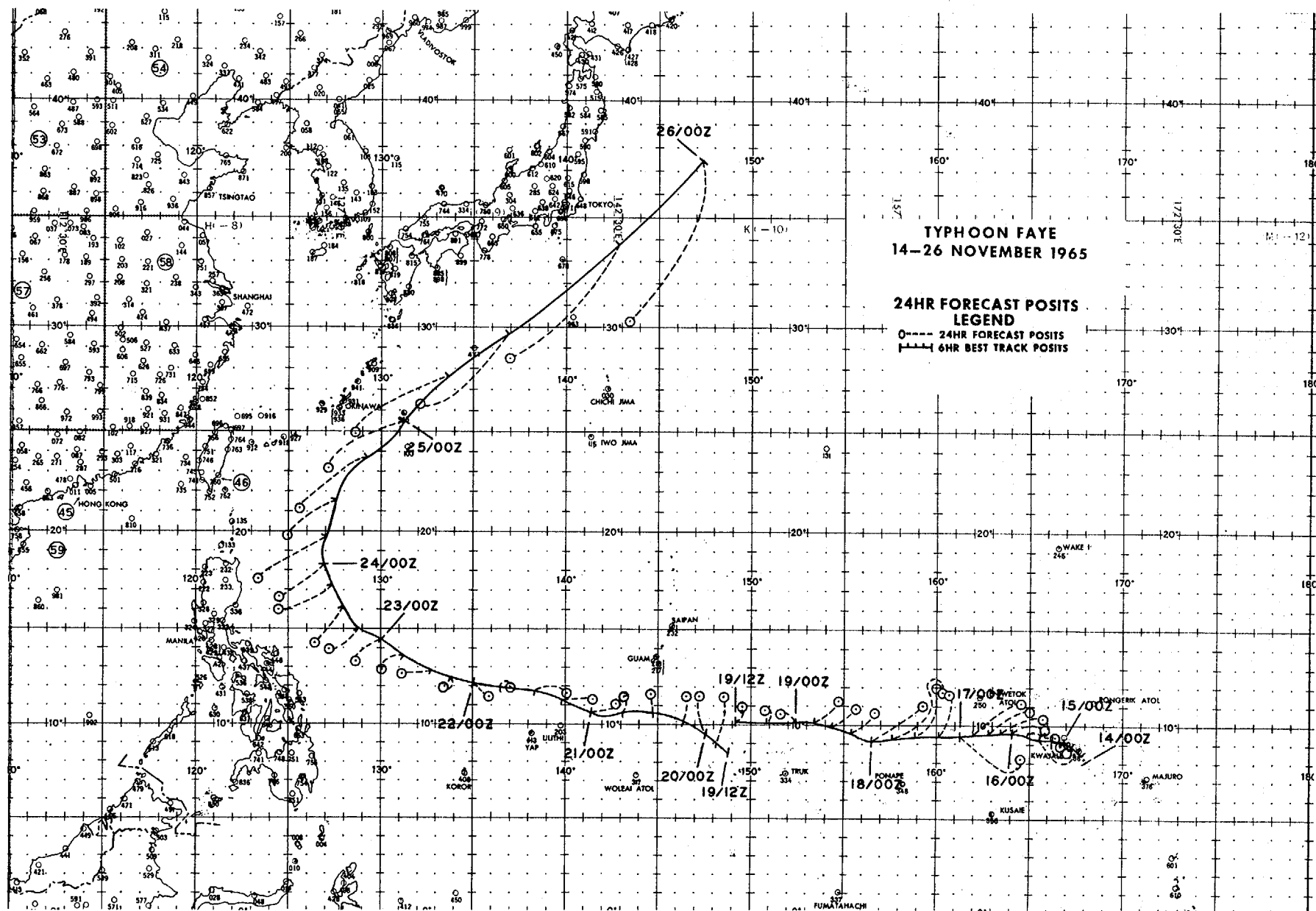
TYPHOON FAYE 14 NOV-26 NOV 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	STORM POSITION		24 HOUR ERROR		48 HOUR ERROR	
	LAT.	LONG.	DEG.	DISTANCE	DEG.	DISTANCE
230000Z	14.4N	130.1E	229	106	168	105
230600Z	15.0N	128.8E	234	119	228	89
231200Z	16.1N	128.1E	218	145	240	130
231800Z	17.2N	127.5E	248	186	237	168
240000Z	18.3N	127.0E	233	170	242	258
240600Z	19.7N	127.1E	238	247	243	327
241200Z	21.6N	127.8E	234	191	234	415
241800Z	23.6N	129.4E	234	261	245	540
250000Z	25.5N	131.3E	238	267	238	630
250600Z	27.6N	133.8E	240	322	240	780
251200Z	29.6N	137.0E	232	325	241	604
251800Z	33.7N	142.9E	224	430	236	829
260000Z	37.4N	147.6E	206	490	231	935

AVERAGE 24 HOUR ERROR 148 MI

AVERAGE 48 HOUR ERROR 268 MI





ANNEX

A

SUMMARY OF TROPICAL CYCLONES

IN THE

NORTHEAST PACIFIC  
(180 DEGREES TO NORTH AMERICAN COAST)

FOR

1965

Fleet Weather Central Alameda and Fleet Weather Central Pearl Harbor issued a total of 244 tropical warnings on 1 hurricane, 9 tropical storms and 2 tropical depressions in the Eastern Pacific in 1965.

The following summary for the Fleet Weather Central Alameda and Fleet Weather Central Pearl Harbor areas is presented for comparison:

# SUMMARY OF EASTERN PACIFIC TROPICAL CYCLONE DATA

	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>
TOTAL NUMBER OF WARNINGS*	147	80	122	80	60	241 (3)**
CALENDAR DAYS OF WARNINGS*	44	25	35	26	21	71 (2)
TROPICAL DEPRESSIONS*						2 (0)
TROPICAL STORMS	2	9	6	5	4	9 (1)
HURRICANES	6	2	2	4	2	1 (0)
TOTAL TROPICAL CYCLONES*	8	11	8	9	6	12 (1)

\*Tropical Depression information not available 1960-1964

\*\*Numbers in parentheses indicate FLEWEACEN Pearl Harbor's data. Data for previous years not available.

Hurricane EMILY was the most intense storm in the FLEWEACEN Alameda area of responsibility during 1965. Maximum winds of 90 knots were estimated based on surface reports.

Tropical Storm DOREEN developed in FLEWEACEN Alameda's area of responsibility and was first located by surface reports at 13.4N 109.0W on 20 August 1965. DOREEN was the only Tropical Cyclone in 1965 to pass into FLEWEACEN Pearl Harbor's area of responsibility. Tropical Storm HAZEL was the most destructive tropical cyclone in the Northeast Pacific. HAZEL moved ashore at Mazatlan, Mexico, on the 26th of September. Numerous lives were lost and extensive damage to property was reported.

Mexico was the only land area affected by hurricanes during the 1965 season.

The 12, 24 and 48 hour mean forecast error was computed by two methods. The standard mean vector forecast error and the closest distance error from best track. Computations are shown in the table below.

Operational positions were based on rather sparse surface reports with frequent assists from satellite reports and pilot debriefs. As a matter of interest one astronaut fix (T.S. DOREEN) was received during the season. Aerial reconnaissance was limited to three flights during Hurricane EMILY.

1965 FORECAST VECTOR ERRORS\*

HURRICANE	12 HR FORECASTS		24 HR FORECASTS		48 HR FORECASTS	
	NO. OF CASES	MEAN ERROR	NO. OF CASES	MEAN ERROR	NO. OF CASES	MEAN ERROR
EMILY	21	40.4	19	66.4	14	107.2

1965 FORECAST ERRORS\*  
(IN TERMS OF CLOSEST DISTANCE TO BEST TRACK)

HURRICANE	12 HR FORECASTS		24 HR FORECASTS		48 HR FORECASTS	
	NO. OF CASES	MEAN ERROR	NO. OF CASES	MEAN ERROR	NO. OF CASES	MEAN ERROR
EMILY	21	23.9	19	50.8	11	62.1

\*Includes forecast errors during tropical storm intensity as well as hurricane intensity.

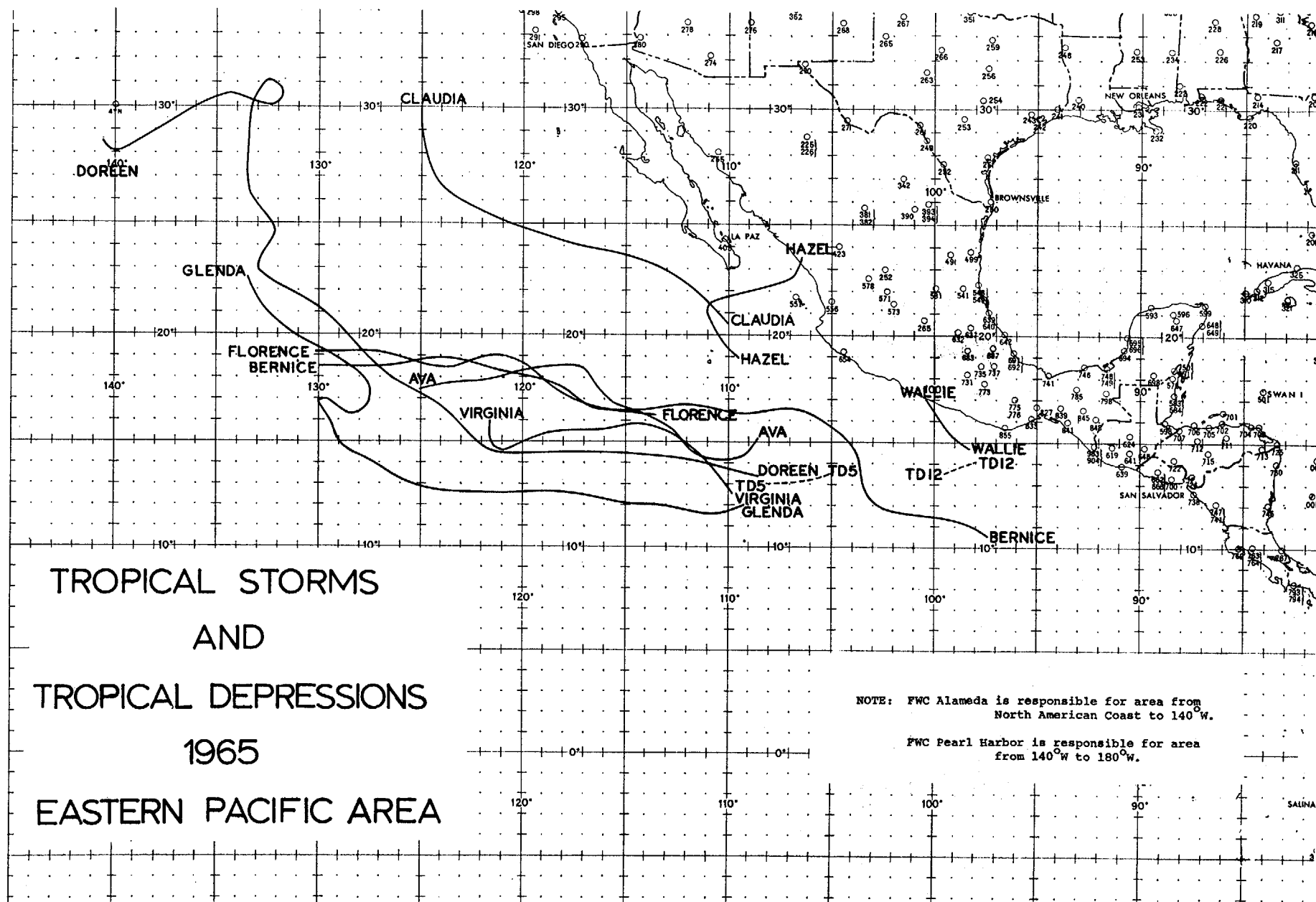
DISTANCE BETWEEN OPERATIONAL WARNING  
POSITIONS AND BEST TRACK POSITIONS

HURRICANE	CASES	AVERAGE	MAX	MIN
EMILY	23	7.6	33	00

# TROPICAL CYCLONES OF 1965

<u>CYCLONE</u>	<u>PERIOD</u>
01. Tropical Storm VIRGINIA	14 JUNE - 17 JUNE
02. Tropical Storm WALLIE	16 JUNE - 18 JUNE
03. Tropical Storm AVA	28 JUNE - 03 JULY
04. Tropical Storm BERNICE	29 JUNE - 08 JULY
05. Tropical Depression	17 JULY - 18 JULY
06. Tropical Storm CLAUDIA	07 AUG - 11 AUG
07. Tropical Storm DOREEN	20 AUG - 31 AUG
08. Hurricane EMILY	29 AUG - 04 SEP
09. Tropical Storm FLORENCE	08 SEP - 14 SEP
10. Tropical Storm GLENDA	13 SEP - 22 SEP
11. Tropical Storm HAZEL	23 SEP - 26 SEP
12. Tropical Depression	21 OCT - 22 OCT

TROPICAL STORMS  
AND  
TROPICAL DEPRESSIONS  
1965  
EASTERN PACIFIC AREA



TROPICAL STORMS 1965  
POSITION DATA

TROPICAL STORM VIRGINIA  
14 JUN-17 JUN

DTG	LAT	LONG	DTG	LAT	LONG
141200Z	12.6N	109.8W	160000Z	15.5N	117.3W
141800Z	12.8N	110.8W	160600Z	15.5N	118.5W
150000Z	15.0N	112.0W	161200Z	15.1N	119.6W
150600Z	15.7N	113.1W	161800Z	14.7N	120.7W
151200Z	15.9N	114.5W	170000Z	16.0N	120.5W
151800Z	15.6N	116.0W			

TROPICAL STORM WALLIE  
16 JUN-18 JUN

161800Z	14.8N	98.2W	171200Z	15.9N	99.6W
170000Z	15.0N	98.7W	171800Z	16.5N	100.0W
170600Z	15.4N	99.2W	180000Z	17.1N	100.4W

TROPICAL STORM AVA  
28 JUN-03 JUL

281800Z	15.2N	108.5W	010600Z	18.3N	116.8W
290000Z	14.5N	109.0W	011200Z	18.5N	111.6W
290600Z	14.2N	110.0W	011800Z	18.5N	118.5W
291200Z	14.3N	111.3W	020000Z	18.3N	119.6W
291800Z	15.5N	112.5W	020600Z	18.1N	120.7W
300000Z	16.4N	114.1W	021200Z	17.9N	121.8W
300600Z	16.7N	115.3W	021800Z	17.8N	123.0W
301200Z	17.1N	115.9W	030000Z	17.6N	124.0W
301800Z	17.5N	116.2W	030600Z	17.4N	125.0W
010000Z	17.9N	116.5W			

TROPICAL STORM BERNICE  
29 JUN-08 JUL

291800Z	10.5N	97.4W	020000Z	11.6N	101.0W
300000Z	10.7N	97.6W	020600Z	11.7N	101.3W
300600Z	10.9N	97.9W	021200Z	11.7N	101.6W
301200Z	11.1N	98.2W	021800Z	11.7N	101.9W
301800Z	11.2N	98.6W	030000Z	11.8N	102.3W
010000Z	11.3N	99.1W	030600Z	12.0N	102.7W
010600Z	11.4N	99.6W	031200Z	12.4N	103.2W
011200Z	11.4N	100.2W	031800Z	13.2N	103.6W
011800Z	11.5N	100.7W	040000Z	14.2N	103.7W

# TROPICAL STORM BERNICE (CONT'D)

040600Z	15.1N	104.2W	061200Z	16.6N	116.7W
041200Z	15.8N	105.0W	061800Z	17.4N	117.8W
041800Z	16.4N	106.0W	070000Z	18.0N	119.4W
050000Z	16.6N	107.3W	070600Z	18.2N	121.4W
050600Z	16.4N	108.7W	071200Z	18.7N	122.4W
051200Z	16.5N	110.5W	071800Z	19.0N	124.1W
051800Z	16.8N	112.0W	080000Z	18.6N	126.0W
060000Z	16.5N	113.7W	080600Z	18.5N	128.0W
060600Z	16.5N	115.2W	081200Z	18.5N	130.0W

## TROPICAL STORM CLAUDIA 07 AUG-11 AUG

070000Z	20.5N	110.0W	090600Z	24.9N	120.0W
070600Z	21.5N	111.0W	091200Z	25.2N	121.2W
071200Z	22.2N	111.9W	091800Z	25.7N	122.2W
071800Z	22.8N	112.9W	100000Z	26.1N	123.2W
080000Z	23.3N	113.9W	100600Z	26.7N	124.1W
080600Z	23.7N	115.1W	101200Z	27.7N	124.6W
081200Z	23.8N	116.2W	101800Z	28.8N	124.9W
081800Z	24.0N	117.4W	110000Z	30.0N	125.0W
090000Z	24.5N	118.5W			

## TROPICAL STORM DOREEN (FWC ALAMEDA) 20 AUG-30 AUG

201200Z	13.4N	109.0W	251800Z	23.0N	133.0W
201800Z	13.9N	110.4W	260000Z	24.1N	132.2W
210000Z	14.1N	111.9W	260600Z	25.4N	132.7W
210600Z	14.3N	113.1W	261200Z	26.2N	133.4W
211200Z	14.4N	114.3W	261800Z	27.0N	133.5W
211800Z	14.5N	115.4W	270000Z	27.8N	133.5W
220000Z	14.5N	116.5W	270600Z	28.8N	133.3W
220600Z	14.5N	117.5W	271200Z	29.8N	133.2W
221200Z	14.5N	118.5W	271800Z	30.5N	133.0W
221800Z	14.5N	119.5W	280000Z	31.2N	132.5W
230000Z	14.5N	120.5W	280600Z	30.4N	131.8W
230600Z	14.6N	121.5W	281200Z	30.1N	132.9W
231200Z	15.3N	122.7W	281800Z	30.6N	133.7W
231800Z	16.5N	123.6W	290000Z	30.7N	134.7W
240000Z	17.3N	125.0W	290600Z	30.4N	135.4W
240600Z	18.0N	126.7W	291200Z	30.0N	136.1W
241200Z	19.2N	127.9W	291800Z	29.6N	136.9W
241800Z	19.9N	128.5W	300000Z	29.0N	138.0W
250000Z	20.7N	129.3W	300600Z	28.6N	138.9W
250600Z	21.3N	130.0W	301200Z	28.1N	139.7W
251200Z	22.0N	131.7W			



TROPICAL STORM DOREEN (FWC PEARL HARBOR)  
30 AUG-31 AUG

301800Z	28.1N	140.2W	310000Z	28.5N	140.5W
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TROPICAL STORM FLORENCE  
09 SEP-14 SEP

081800Z	16.3N	113.5W	111800Z	18.9N	120.2W
090000Z	16.4N	114.3W	120000Z	19.0N	120.7W
090600Z	16.5N	115.1W	120600Z	19.1N	121.4W
091200Z	16.6N	115.9W	121200Z	18.9N	122.1W
091800Z	16.8N	116.6W	121800Z	18.6N	123.0W
100000Z	16.9N	117.1W	130000Z	18.5N	124.0W
100600Z	17.1N	117.6W	130600Z	18.8N	125.0W
101200Z	17.3N	118.1W	131200Z	19.0N	126.0W
101800Z	17.6N	118.5W	131800Z	19.2N	127.0W
110000Z	17.9N	118.9W	140000Z	19.2N	128.0W
110600Z	18.3N	119.3W	140600Z	19.2N	129.0W
111200Z	18.7N	119.7W	141200Z	19.2N	130.0W

TROPICAL STORM GLENDA  
13 SEP-18 SEP

130000Z	12.0N	109.2W	180000Z	15.9N	129.2W
130600Z	11.6N	110.4W	180600Z	16.5N	129.8W
131200Z	11.8N	111.8W	181200Z	17.0N	130.0W
131800Z	12.0N	113.0W	181800Z	17.0N	129.5W
140000Z	12.0N	114.3W	190000Z	16.7N	129.2W
140600Z	12.2N	115.5W	190600Z	16.2N	128.6W
141200Z	12.4N	116.7W	191200Z	16.5N	127.9W
141800Z	12.6N	117.9W	191800Z	17.1N	127.4W
150000Z	12.7N	119.0W	200000Z	17.8N	127.5W
150600Z	12.7N	120.0W	200600Z	18.3N	128.0W
151200Z	12.7N	121.0W	201200Z	18.7N	128.6W
151800Z	12.7N	122.2W	201800Z	19.1N	129.3W
160000Z	12.7N	123.5W	210000Z	19.4N	130.0W
160600Z	12.8N	124.5W	210600Z	19.7N	130.7W
161200Z	13.0N	125.4W	211200Z	20.1N	131.4W
161800Z	13.3N	126.0W	211800Z	20.5N	132.0W
170000Z	13.7N	126.6W	220000Z	21.0N	132.5W
170600Z	14.1N	127.3W	220600Z	21.5N	132.8W
171200Z	14.5N	128.3W	221200Z	22.0N	133.1W
171800Z	15.0N	129.0W	221800Z	22.6N	133.4W

## TROPICAL STORM HAZEL

23 SEP-26 SEP

231800Z	19.0N	109.5W	251200Z	21.7N	110.3W
240000Z	19.4N	109.8W	251800Z	21.9N	109.6W
240600Z	19.7N	110.2W	260000Z	22.1N	108.7W
241200Z	20.0N	110.5W	260600Z	22.3N	107.7W
241800Z	20.3N	110.8W	261200Z	22.7N	106.9W
250000Z	20.8N	111.0W	261800Z	23.5N	106.3W
250600Z	21.4N	110.9W			

TROPICAL DEPRESSIONS 1965

POSITION DATA

TROPICAL DEPRESSION 05

17 JUL-18 JUL

DTG	LAT	LONG	DTG	LAT	LONG
171800Z	13.5N	105.0W	180600Z	13.0N	107.0W
180000Z	13.1N	105.9W	181200Z	13.0N	108.0W

TROPICAL DEPRESSION 12

21 OCT

210600Z	13.5N	99.5W	211200Z	14.0N	98.0W
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HURRICANE EMILY - 291800Z AUGUST TO 040600Z SEPTEMBER

I. DATA

A. Statistics

1. Number of warnings issued - 25
2. Number of warnings with hurricane intensity - 2
3. Total distance traveled during tropical warning period -

1122 mi.

B. Characteristics as a hurricane

1. Minimum observed SLP - 980mb, 311500Z
2. Minimum observed 700mb height - 3100m, 030000Z
3. Maximum surface wind - 90 kts
4. Max radius of surface circulation - 540 mi

II. DEVELOPMENT

A. Initial impetus - ITCZ

B. Initial surface vortex

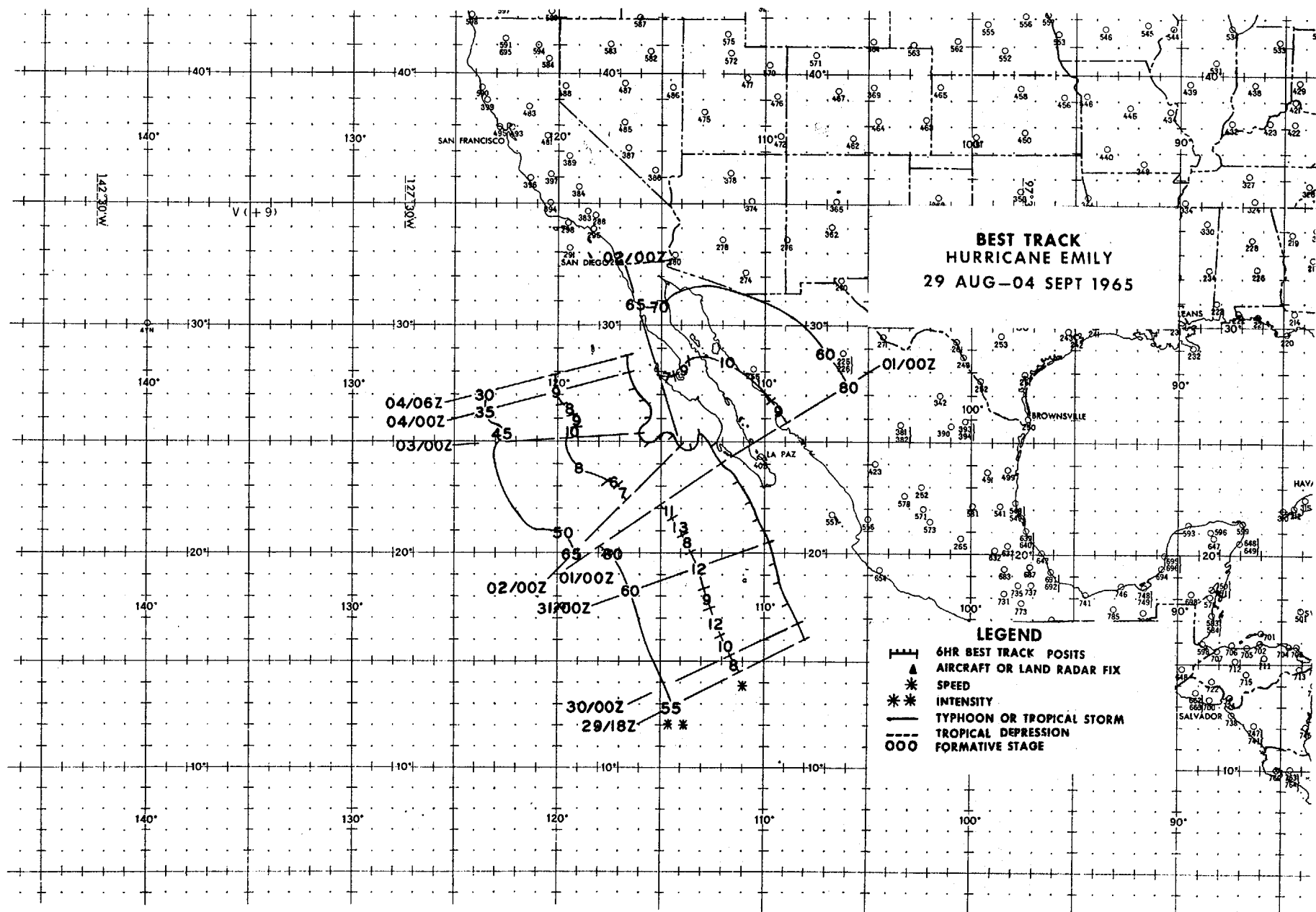
1. 291800Z
2. Surface pressure less than 1000mb

C. 200mb flow above surface vortex

1. No data available

III. FINAL DISPOSITION

A. Dissipated



HURRICANE EMILY 29 AUG - 4 SEP 1965  
POSITION AND FORECAST VERIFICATION DATA

DTG	BEST TRACK STORM POSITION		24 HR ERROR	48 HR ERROR
	LAT	LONG	DEG. DISTANCE	DEG. DISTANCE
291800Z	16.0N	108.0W	-----	-----
300000Z	16.8N	108.3W	-----	-----
300600Z	17.7N	108.8W	-----	-----
301200Z	18.6N	109.2W	-----	-----
301800Z	19.5N	109.5W	284-48	-----
310000Z	20.5N	109.8W	045-9	-----
310600Z	21.5N	110.2W	315-16	-----
311200Z	22.2N	110.5W	171-110	-----
311800Z	23.2N	111.2W	236-22	265-120
010000Z	24.0N	112.0W	090-48	073-63
010600Z	24.7N	112.5W	055-121	300-35
011200Z	25.3N	113.1W	080-104	144-222
011800Z	24.7N	113.4W	053-158	357-108
020000Z	24.7N	114.0W	346-148	360-132
020600Z	25.3N	114.4W	020-210	004-180
021200Z	25.4N	114.9W	011-230	002-197
021800Z	25.0N	115.5W	343-102	054-370
030000Z	25.4N	116.0W	355-66	011-280
030600Z	26.0N	115.5W	355-132	-----
031200Z	26.7N	115.7W	284-98	030-420
031800Z	27.2N	116.2W	210-153	329-148
040000Z	27.9N	116.4W	209-205	313-90
040600Z	28.6N	116.6W	119-89	023-168

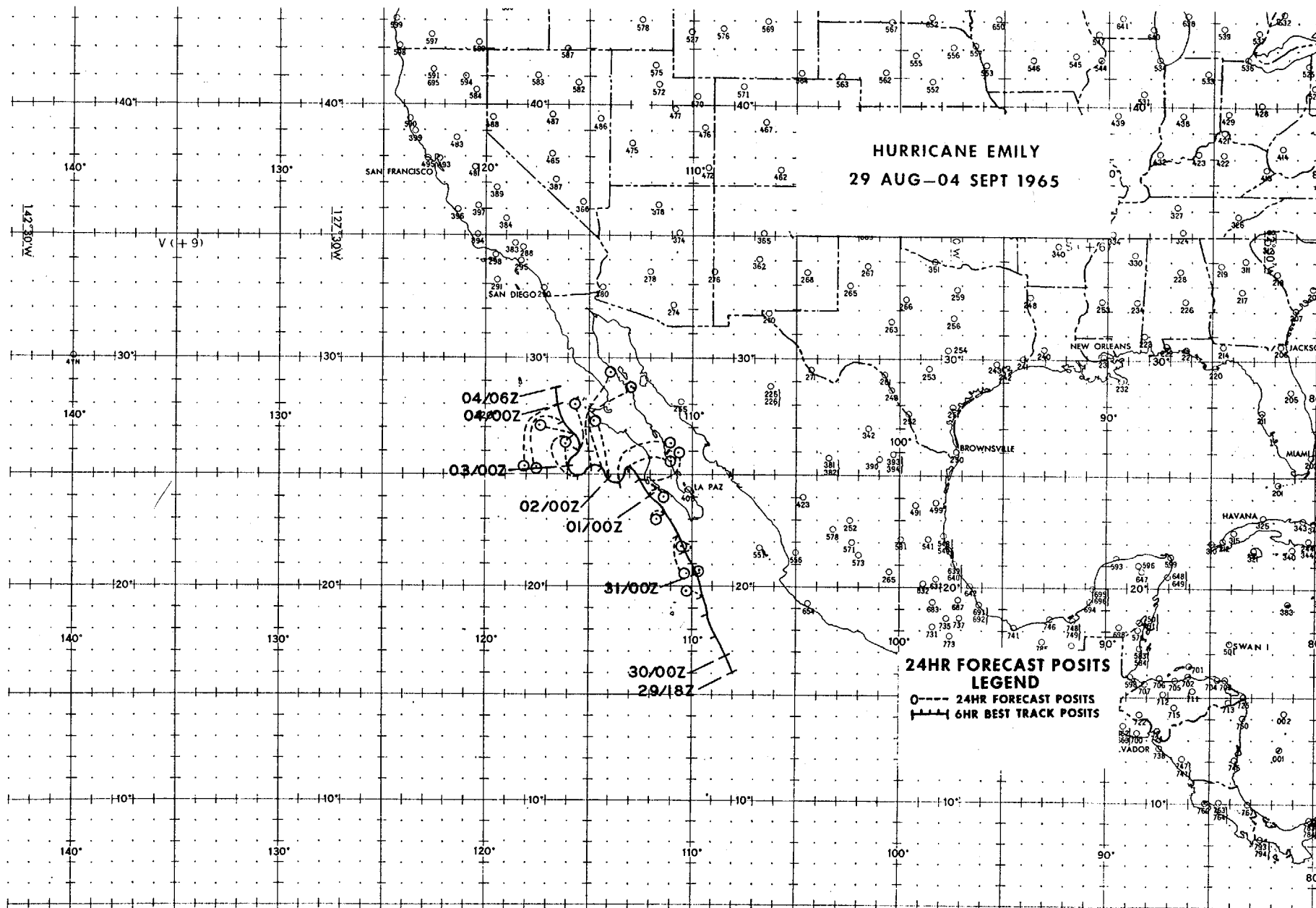
Two intermediate positions of interest.

Warning No. 9 311500Z 22.5N 110.5W 90KTS near center. Good based on surface reports.

Warning No. 14 011500Z 24.5N 113.7W 70 KTS near center. Based on surface reports.

# HURRICANE EMILY OPERATIONAL TRACK

DTG(Z)	POSITION		WARNING #	INTENSITY	INTENSITY COMPARISON	
	LAT	LONG			24 HR FORECAST	48 HR FORECAST
291800Z	16.0N	108.0W	1	55KTS	---	---
300000Z	16.8N	108.3W	2	55	---	---
300600Z	18.0N	109.0W	3	55	---	---
301200Z	18.5N	109.5W	4	55	---	---
301800Z	19.5N	109.5W	5	55	55K	---
310000Z	20.5N	109.8W	6	60	55	---
310600Z	21.5N	110.2W	7	60	50	---
311200Z	22.2N	110.5W	8	60	55	---
311800Z	23.0N	110.7W	10	80	55	55
010000Z	24.0N	112.0W	11	80	60	55
010600Z	24.7N	112.5W	12	60	50	50
011200Z	25.5N	113.2W	13	60	50	55
011800Z	24.5N	113.5W	15	70	65	55
020000Z	24.7N	113.9W	16	65	65	60
020600Z	25.3N	114.4W	17	50	60	40
021200Z	25.7N	114.8W	18	50	35	40
021800Z	25.0N	115.5W	19	50	70	45
030000Z	25.0N	116.0W	20	50	60	50
030600Z	26.0N	115.5W	21	45	50	DISSIPATED
031200Z	26.3N	115.5W	22	45	40	DISSIPATED
031800Z	27.2N	116.2W	23	40	40	60
040000Z	27.5N	116.4W	24	35	40	50
040600Z	28.6N	116.6W	25	30	35	40





## APPENDIX A

### ABBREVIATIONS AND DEFINITIONS

1. Certain words and phrases that appear frequently in this report are abbreviated as follows:

ACFT	Aircraft
APPR(S)	Appear(s)
APROX	Approximately
BND(G)(S)	Band, Banding, Bands
BRK(S)	Break(s)
BRKN	Broken
CINCPAC	Commander in Chief, Pacific
CINCPACAF	Commander in Chief, Pacific Air Force
CIRC	Circular
CIRCN	Circulation
CLD(S)	Cloud(s)
CLR	Clear
CLSD	Closed
CNTR(S)(D)	Center(s)(ed)
DEF	Definite
DEG	Degree
DVLP(G)	Develop(ing)
DFUS	Diffuse
DIA	Diameter
DSPTG	Dissipating
DSPTN	Dissipation
E	East
ELIP	Elliptical
ELONG	Elongated
EST or E	Estimated
F	Fair
FAFWC	Fuchu Air Force Weather Central, Fuchu Air Station, Japan
FDR	Feeder
54WRS	54th Weather Reconnaissance Squadron, Andersen Air Force Base, Guam, M. I.
56WRS	56th Weather Reconnaissance Squadron, Yokota Air Base, Japan
FM	From
FNWF	Fleet Numerical Weather Facility, Monterey, California
FWC/JTWC	Fleet Weather Central/Joint Typhoon Warning Center, Guam, M. I.
INDEF	Indefinite
ITCZ	Intertropical Convergence Zone
JMA	Japan Meteorological Agency
JMG PACOM	Joint Meteorological Group, Pacific Command
K (KILO) Time	Mariana Islands local time
KM	Kilometer(s)
KT	Knot(s)
L	Poor

LGT	Light
LND	Land
M	Meter(s)
MAX	Maximum
MB	Millibar(s)
MI	Mile(s)
MIN	Minimum
MISC	Miscellaneous
MOD	Moderate
MPT	Mid-Pacific Trough
N	North
NA	Not applicable
NEG	Negative
NMC	National Meteorological Center
OVC	Overcast
POS or P	Positive
POSIT(S)(D)	Position(s)(ed)
PRES	Pressure
PROB	Probable
PSBL	Possible
QUAD(S)	Quadrant(s)
RDR	Radar
RPT	Report
S	South
SEMI	Semicircle
SFC	Surface
SLP	Sea level pressure
SML	Small
STA	Station
STG	Strong
STM	Storm
TEMP	Temperature
THK	Thick
U	Unknown
V	Visual
VSBL	Visible
VW-1	Airborne Early Warning Squadron ONE, NAS Agana, Guam, M. I.
W	West
WESTPAC	Western North Pacific Area
WK	Weak
WND	Wind(s)
WX	Weather
XTNSV	Extensive

2. The following define and clarify certain words and phrases that appear in the Eye Fix Summaries in Chapter V.

- a. FIX NO. - This number corresponds to the number of the fix plotted on the "Best Track Chart."

- b. TIME - The date-time of the fix.
- c. POSIT - Latitude and longitude of the fix.
- d. UNIT, METHOD & ACCY:
  - (1) UNIT - The unit that made the fix: 54 - 54WRS; 56 - 56WRS; VW1 - VW-1.
  - (2) METHOD - The method used to make the fix: P - penetration; R - radar; LND/RDR - land radar; TIROS - TIROS Satellite.
  - (3) ACCY - Center determination and estimated accuracy of the fix: P - positive; F - fair; L - poor/distance in nautical miles.
- e. FLT LVL - Altitude of aircraft at time of fix.
- f. FLT LVL WND - Maximum observed flight level wind in knots.
- g. OBS SFC WND - Maximum observed surface wind in knots.
- h. OBS MIN SLP - Minimum sea level pressure observed in MBS.
- i. MIN 700MB HGT - Minimum 700mb height observed in meters.
- j. FLT LVL TT/TD - Flight level temperature/dew point at fix location. (When flight level is near the 700mb level, the 700mb temperature/dew point is recorded in place of the actual flight level data.
- k. Supplementary Explanations (Examples used in Chapter V):
  - 15X5 NE-SW Major axis NE-SW 15 mi long; Minor axis NW-SE 5 mi long.
  - 54-E-U Fix made by 54WRS; Estimated; Center determination and accuracy not given
  - VW1-R-P4 Fix made by VW-1; Radar; Center determination positive and navigation accuracy given as 4 miles.
  - 54-P-F6 Fix made by 54WRS; Penetration; Center determination fair and navigation accuracy 6 miles.

3. An investigation is the traverse of a reconnaissance aircraft over an area containing a suspected circulation.

4. A fix is the determination of the position of a tropical cyclone at a precise time. Generally, the term "fix" is used when the position of the cyclone has been determined by a reconnaissance aircraft penetration or by airborne, land or ship radar. In the case of a reconnaissance aircraft penetration, the actual fix may be based on one or more of the following:

visual observation, radar, surface pressure, surface or upper level winds, constant pressure height, and temperature/dew point.

5. The term "tropical cyclone" or "cyclone" as used in this publication has two definitions dependent upon usage.

a. "Tropical cyclone" or "cyclone" is used to describe a suspected tropical cyclonic circulation which appears capable of intensification.

b. "Tropical cyclone" or "cyclone" is used in the general sense, e.g., "Typhoon JOAN was the most intense tropical cyclone of 1959," or "Tropical cyclones more frequently develop during August and September."

(1) A "Tropical Depression" (TD) as used by JTWC is a tropical cyclone with a confirmed cyclonic circulation for which warnings are being issued and whose surface wind speeds do not exceed 33 knots. Tropical depressions are numbered.

(2) A "Tropical Storm" (TS) is a tropical cyclone in which the maximum surface wind speed is no more than 63 knots, but greater than 33 knots. Tropical storms are named.

(3) A "Typhoon" is a tropical cyclone located W of 180 DEG longitude in which the maximum surface wind speed is 64 knots or greater.

6. Recurvature - That point at which the cyclone ceases movement to the W of N and commences moving to the E of N.

7. Vortices:

a. Embedded vortex of easterly wave - closed cyclonic circulation along easterly wave and separated from ITCZ.

b. Junction vortex - closed cyclonic circulation at the junction of easterly wave and ITCZ.